PERSISTENCE AND HYPERPLASIA OF THE PRIMARY VITREOUS

(TUNICA VASCULOSA LENTIS OR RETROLENTAL FIBROPLASIA)

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This condition, which usually manifests itself as a bilateral congenital lesion of premature infants, has always appeared sporadically, but of late there has been an increased incidence, probably stemming from a lower mortality of premature babies. In the past decade or more, a number of measures adopted by the pediatricians have contrived to save the lives of many premature babies formerly lost. This seems to be an important reason why the lesion under discussion is encountered more frequently now.

We wish to report on 50 cases which, we believe, belong to this group, and the following table shows that the incidence of our cases has been higher during the past decade.

The first reference we can find to this condition dates back to 1851 (Howard[1]) and since then many articles have appeared describing various clinical and pathologic aspects of the lesion under various synonyms some of which are as follows: persistent thickened hyaloid artery with secondary changes (Nettleship,[2] 1873), persistent hyaloid canal and artery (Gardiner,[3] 1880), persistence and

thickening of the posterior fibrovascular sheath of the lens (Collins,[4] 1892; Pollock,[5] 1923), atypical development of the anterior part of the vitreous with or without a persistent hyaloid artery (Collins,[4]

TABLE 1

YEAR OF BIRTH OF INFANTS IN 50 CASES

	Full-Term	Pre-mature	Total
1930	1	—	1
1931	—	—	—
1932	—	—	—
1933	1	—	1
1934	1	—	1
1935	—	—	—
1936	1	—	1
1937	2	—	2
1938	1	2	3
1939	2	—	2
1940	3	3	6
1941	2	3	5
1942	1	4	5
1943	2	7	9
1944	3	8	11
1945	—	3	3

1892), congenital membrane behind the lens (Parsons,[6] 1902), persistence of remains of the tunica vasculosa lentis (Bruckner,[7] 1907), persistent posterior fibrovascular sheath of the lens (Lane,[8] 1919), persistence of embryonic fibrovascular sheath of the crystalline lens (Lent and Lyon,[9] 1922), remains of the tunica vasculosa lentis (Gifford and Latta,[10] 1923; Lloyd,[11] 1931), pseudophakia fibrosa of Czermak (Fuchs,[12]

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1923), opaque membrane behind the lens (Collins and Mayou,[13] 1925), shrunken fibrous tissue cataract (Collins and Mayou,[14] 1925), posterior lenticonus (Collins and Mayou,[15] 1925), congenital connective tissue formation in the vitreous chamber (Collins and Mayou,[16] 1925), posterior polar cataract (Mann,[17] 1937), fibrous tissue cataract (Mann,[18] 1937), persistence of the vascular sheath of the lens (Duke-Elder,[19] 1938), fibroblastic overgrowth of persistent tunica vasculosa lentis (Terry,[20] 1942), and retrolental fibroplasia (Terry,[21] 1942). We believe that all of these references refer to various manifestations of the same basic lesion. Terry, in a series of papers[20-24] in which he gave the results of his most thorough study of this subject, chose the term "retrolental fibroplasia." This term is acceptable but we feel "persistence and hyperplasia of the primary vitreous" more accurately designates the lesion.

Terry employed the term "retrolental fibroplasia" to designate primarily a condition occurring bilaterally in premature babies after birth (not earlier than four months). He felt that this is a new, acquired condition different from the lesion which is unilateral at the time of birth in full-term infants. From the study of our cases and the literature we do not believe such a distinction is justified but that the same lesion may occur in both premature and full-term babies, that it may be unilateral or bilateral, and that all are congenital but may not manifest themselves until sometime after birth either because they are not looked for or because the lesion progresses.

AGE WHEN ABNORMALITY WAS OBSERVED

The age of the patient when the parents or physician first noted any ocular abnormality is stated in 15 of our records.

In nine patients the lesion was noted during the first week after birth:

Number Cases	Term	Noted
1	premature	at birth
3	full-term	at birth
1	full-term	on 2d day
1	full-term	on 3d day
1	full-term	on 4th day
1	full-term	within a week
1	premature	within a week

In six patients the lesion was noted at later dates:

Number Cases	Term	Noted
1	full-term	on 23d day
1	full-term	at 4 weeks
1	full-term	at 5 weeks
1	premature	at 10 weeks
1	full-term	at 4 months
1	premature	at 5 months

The records of the remaining 35 patients in some cases do not state specifically the time at which the parents observed something abnormal about the infant's eyes; in other cases the parents did not notice anything unusual until the baby was three months old or older, although they had suspected for a long time that the baby was not seeing things; however, they did not become seriously concerned until the baby was several months old.

On the basis of the embryology and pathology concerned, which will be discussed later, it is difficult to conceive of the tissue being absent at birth and forming subsequently. We know that remains of the hyaloid system and other congenital abnormalities in the structures of the eye are frequent accompaniments of the lesion. Our thesis is that in these cases the primary vitreous, which is a vascularized mesoderm, persists in some or all of its phases at birth and may show re-

gressive or progressive changes. Progressive changes, from the clinical aspect, may be due to actual hyperplasia of this mesoderm or to secondary factors such as hemorrhage, contracture, swelling of the lens, secondary glaucoma, and corneal opacity from contact of the lens and iris with the posterior surface of the cornea. The nature of these secondary changes will be pointed out when the pathology is discussed.

Prematurity. What constitutes a premature baby is not always clear. For our purposes we have chosen a birth weight of under five pounds or, in instances wherein the birth weight is lacking (15 of our cases), an infant born before a nine-months' period of gestation had been completed to designate prematurity. This criterion divided our 50 cases as follows:

30 (60 percent) were premature infants.

20 (40 percent) were full-term infants.

Laterality. Of 30 premature infants the involvement in 28 was bilateral; in 2 unilateral. In one of these there was a juxtapapillary area of chorioretinal atrophy in the fellow eye. Of 20 full-term infants the involvement in 7 was bilateral; in 13 unilateral. In one of these hydrophthalmos was present in the fellow eye.

Thus, of 50 cases, 35 were bilateral and 15 were unilateral.

Sex and color. Of 50 cases 31 were in males, 19 in females. All patients were white except in 1 case, a Negro.

Twins and Triplets. 3 cases were in twins, 2 cases were in 2 of triplets; the third sibling died at the age of three days and the ocular status was not known.

CLINICAL TYPES

The clinical appearance of this basic condition is varied and depends on several factors: (1) stage of cessation of the normal involution or disappearance of the

primary vitreous including the hyaloid system; (2) amount and character of the hyperplasia of the mesoderm of the primary vitreous; (3) extent and character of the secondary changes (hemorrhage, contracture, glaucoma, swelling of the lens, contact of iris-lens diaphragm with the cornea, and the like).

It is convenient to divide the clinical manifestations into four types as follows:

I. Saucer-shaped, whitish opaque tissue conforming to the posterior surface of the lens (figs. 1 to 5);

II. An opaque cornea, greatest in the central portion, usually associated with glaucoma, and maybe buphthalmos (figs. 6 to 9);

III. A localized area of opaque tissue on the posterior surface of the lens, or at the lens equator, or in the anterior vitreous, with or without retinal detachment (figs. 10 to 14);

IV. Remains of the hyaloid system (fig. 15).

These four clinical types are not necessarily sharply demarcated but may merge. Type I may change into type II, or there may be type I in one eye and type II in the fellow eye. Otherwise one type cannot go over into another type.

Type I. This appears as a concave, saucer-shaped whitish opaque tissue against the posterior surface of the lens (fig. 1). It is the typical and most frequent manifestation of the lesion. The globe is smaller than normal in size, the cornea is clear, and the anterior chamber shallow. The lens is clear, but against the convexity of its posterior surface is applied this whitish tissue whose surface is concave to fit the convexity of the lens. Blood vessels of varying size and number are usually visible in the opaque tissue. The tissue covers the greater part of the posterior surface of the lens, but the central portion is densest and there is a
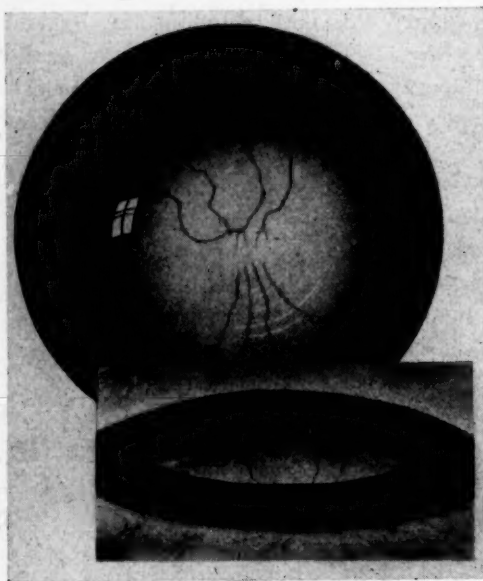
Fig. 1 (Reese and Payne). Clinical type-I lesion. Above is shown the concave opaque tissue containing blood vessels which radiate from the center. The density of the lesion decreases from the center to the periphery, where it is more or less transparent. Below is shown the elongated ciliary processes inserted into the periphery of the retrolental opacity. This is the drawing of the left eye of the twin whose eye is shown in figure 14.

gradual thinning toward the periphery of the lens, where frequently the fundus reflex, or even some details of the fundus, may be seen. Around the equator of the lens long narrow ciliary processes in one or more sectors can be seen either free or extending into the periphery of the membrane. These processs can usually be seen clinically (figs. 1 and 10) if looked for, and when present they are pathognomonic of this condition.

From this usual, clinical appearance, just described, there may be some variation, discussion of which follows.

The size of the globe was mentioned in the clinical description of 23 cases. Of these, the globes were larger than normal in both eyes in two bilateral cases; the globe was larger than normal in one eye

and smaller than normal in the fellow eye in one bilateral case. In all other cases, the eyes appeared to be smaller than normal. Microphthalmos was present in 7 unilateral cases and 12 bilateral cases. It was present in both premature and full-term infants.

It is felt that the enlargement of the globes was due to glaucoma. We found the intraocular pressure elevated in several cases of microphthalmos according to the tonometric readings. It is difficult to discuss glaucoma in these cases with confidence, owing to the fact that the tonometer discs and footplates are gauged for a normal adult cornea and not for the
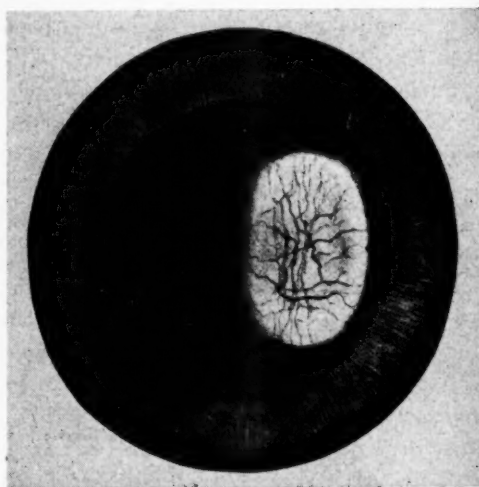
Fig. 10 (Reese and Payne). Clinical type-III lesion without retinal detachment at two days of age (noted by father who is a doctor). At two months of age a hemorrhage was noted over the surface of the lesion and in the course of several weeks this hemorrhage became absorbed. After 1½ to 2 years the blood vessels disappeared, and now, at the age of 5 years, the lesion is the same size, somewhat less dense, avascular, and with a small localized almost chalky-white area interpreted as a focus of calcium deposit. This illustration was made when the patient was nine days old, and shows a vertically oval, whitish-opaque, vascularized lesion located on the posterior surface of the lens. Elongated ciliary processes are seen extending toward the lesion (case of Doctor M. U. Troncoso).

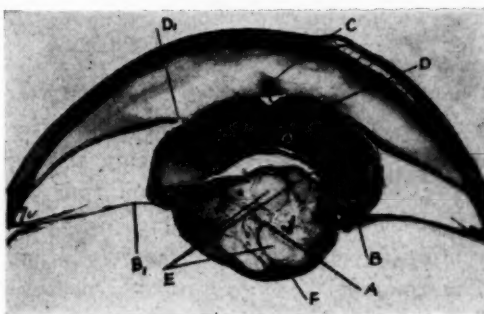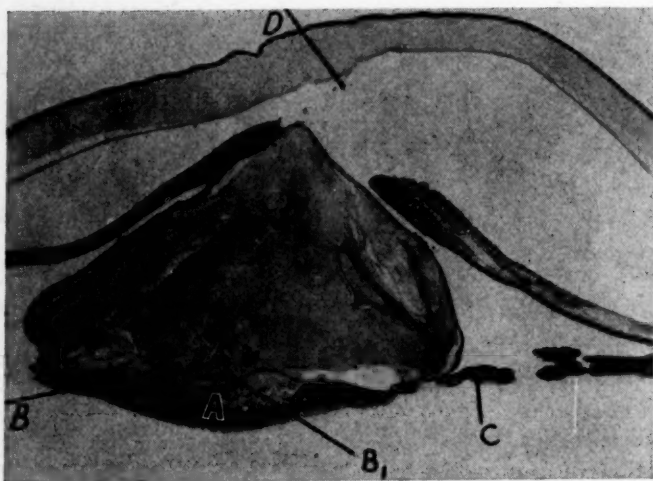Fig. 2 (Reese and Payne). A portion of a human eye showing persistence and hyperplasia of the primary vitreous corresponding to clinical type I. The retrolental fibrous mass is shown at A with the hyaloid artery at B. The lens is small. Ciliary processes, C and C', extend to the fibrous mass, and the retina is seen as far as D.
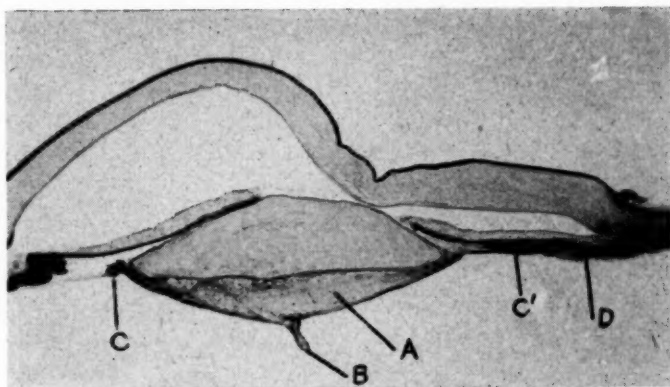
cornea of an infant or for a microcornea. In these cases the determination of the intraocular pressure by palpation is perhaps more accurate than by tonometer. Terry stated that "in spite of glaucoma the eyes have not become enlarged." This has been our experience provided we have been accurate in determining the presence of an increased intraocular pressure. We have the impression, however, that these eyes are not prone to develop buphthalmos in the presence of what seems to us to be a definitely increased pressure.

One of the most important factors in the production of glaucoma is the narrowing of the anterior chamber and blocking of the filtration angle due to advancement of the iris-lens diaphragm. This is produced by (1) swelling of the lens from an opening in its posterior capsule; (2) contracture of the fibrous membrane behind the lens, pushing the lens and iris forward (suggested by Terry. in a personal communication) ; (3) massive hemorrhage in the vitreous. Another factor is the presence of an embryonic filtration angle in some of these cases.

The clinical appearance does not always remain the same but may present a changing picture. The later occurrence of glaucoma is particularly noted, and concurrent with this are usually a decrease or even a disappearance of the anterior

Fig. 3 (Reese and Payne). A section of a human eye showing persistence and hyperplasia of the primary vitreous corresponding to clinical type I. The large retrolental mass, A, extends for some distance forward into the lens, giving the lens a kidney shape. At B and B₁ rudimentary ciliary processes along with some of the retina extend to the periphery of the mass. An anterior pyramidal cataract is shown at C. A pupillary membrane is seen at D and D₁. In the retrolental mass are large areas of cartilage, E, blood vessels, and the tissue at F is thought to be smooth muscle. Peripheral synechiae are present.

chamber, a stippling and opacity of the cornea of varying degree, and cataractous changes.

Hemorrhage may occur from the vessels in the opaque retrolental tissue. We have observed this clinically in three cases.

Typically, the retrolental tissue is concave (fig. 2), but this tissue may be sufficiently hyperplastic to extend into the lens substance and therefore present a

Fig. 7 (Reese and Payne). A section of a human eye showing persistence and hyperplasia of the primary vitreous corresponding to clinical type II. The retrolental fibrous mass is shown at A, and the posterior lens capsule is open from B to B₁. A higher magnification of this site is shown in figure 8. The ciliary processes, C, extend to the fibrous plaque. The lens is swollen and protrudes forward along with the iris to the cornea. *In vivo* the apex of the lens, along with the adjacent iris, rested against the cornea at D (see figure 9).

convex surface (fig. 3). Blood vessels may or may not be seen in the opaque tissue; if present they may disappear in time.

The lens may become cataractous preventing a view of the retrolental tissue. The cataract develops probably because the posterior lens capsule is opened (fig. 7).

Type II. This is characterized by an opacity of the cornea beginning in the central portion and spreading peripherally but always densest centrally (fig. 6). The anterior chamber is absent or shallow. The corneal epithelium shows stippling, more marked centrally and diminishing peripherally. Glaucoma is present and if of long standing there may be buphthalmos.
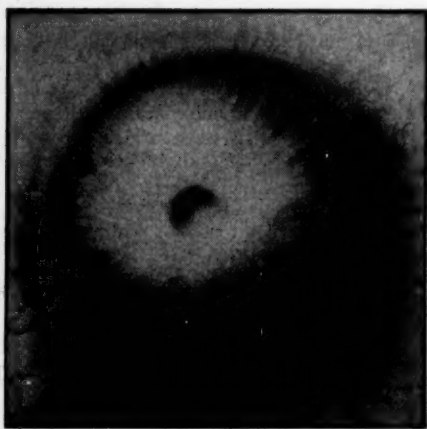
Fig. 6 (Reese and Payne). Clinical type II. The opacity of the cornea is greatest in the central portion. There is diminished luster with stippling of the epithelium. The anterior chamber is absent where the lens and iris touch the cornea and extremely shallow elsewhere.
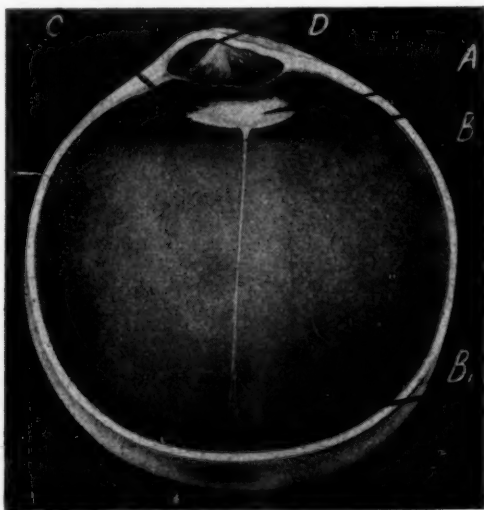
Fig. 9 (Reese and Payne). The gross appearance of the eye shown in figures 7 and 8. One side of the globe has been removed. The retrolental fibrous tissue is seen at A, with the hyaloid artery, B to B₁ coursing from the posterior surface to the disc. The zone of long ciliary processes extending into the retrolental mass is seen at C. The lens and iris extend forward to touch the cornea at D.

Fig. 15 (Reese and Payne). The clinical appearance of a case in which the features of clinical type IV dominate those of clinical type I. The patent hyaloid artery containing blood is seen extending from the disc to the posterior surface of the lens while along the posterior surface of the lens there is a fine lacelike pattern of fibrous tissue which might be interpreted as some persistence of the primary vitreous without hyperplasia. This is in contrast to clinical type I, in which the persistence of the hyaloid system plays a secondary role. Clinical type IV in its most typical form is persistence of the hyaloid system without the retrolental lesion, just a clinical type I is the retrolental lesion without the hyaloid system (case of Dr. Charles A. Perera).
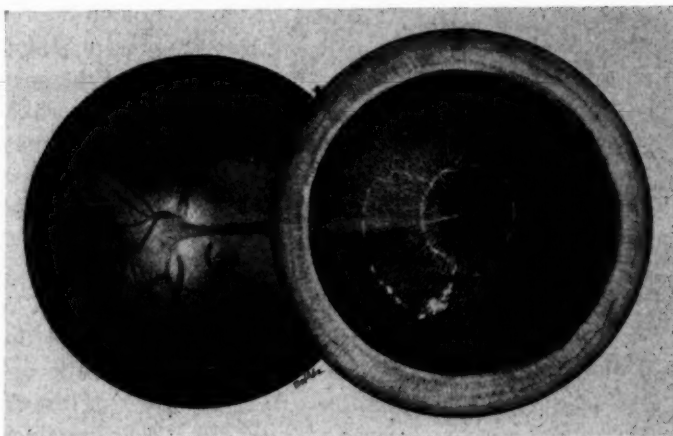
Type I may develop into type II. The corneal changes which dominate the clinical picture are due primarily to an advancement of the iris-lens diaphragm forward so that some of the iris and lens, and particularly the central portion, are in apposition to the posterior surface of the cornea (figs. 7 and 9). This interferes with the impermeability of the corneal endothelium, permits aqueous to enter the stroma, and produces changes leading to opacification, including pannus formation. The same advancement of the iris-lens diaphragm embarrasses the filtration angle and usually leads to glaucoma. The presence of increased intraocular pressure tends to increase the corneal edema. As previously mentioned in discussing glaucoma, the advancement of the iris-lens diaphragm is due to swelling of the lens, contracture of the fibrous sheath behind the lens, and perhaps intraocular hemorrhage. These factors will be considered further when the pathology is discussed.

The corneal opacity prevents an accurate view of the interior of the eye, and frequently the retrolental fibrous tissue is not visible, especially through the central portion of the cornea. The presence of a partially or totally cataractous lens adds to the difficulties. This type may occur in premature or full-term infants and may be unilateral or bilateral. When
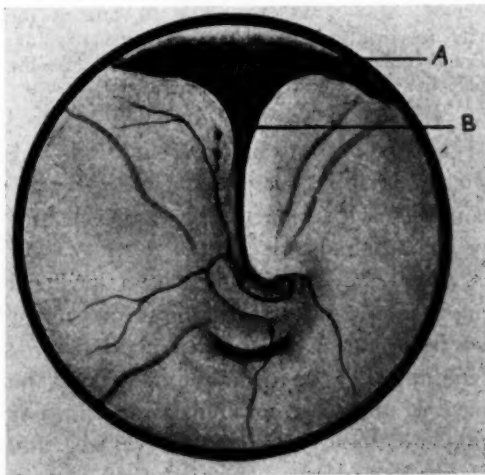
Fig. 11 (Reese and Payne). Clinical type III lesion with retinal detachment. The fibrous plaque of tissue located at the posterior equatorial region of the lens is seen at A, and from it a fibrous extension, B, courses backward to the retina, which is detached. There was a partial coloboma of the optic disc. This patient, who has a similar lesion in the fellow eye, was one of triplets one of whom died and the other had persistence and hyperplasia of the primary vitreous clinical type I in one eye and clinical type II in the fellow eye.
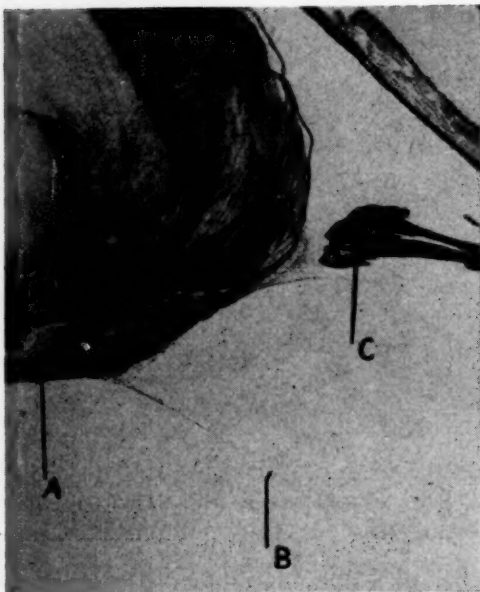
Fig. 12 (Reese and Payne). A section of a human eye showing persistence and hyperplasia of the primary vitreous corresponding to clinical type III. From the retrolental fibrous plaque, A, a strand of tissue, B, crosses the vitreous to attach to the retina (see figure 13). Long ciliary processes, C, extend to the periphery of the retrolental tissue.

type I is present in the fellow eye the diagnosis is easier. This type is easily confused with congenital hydrophthalmos or buphthalmos.

Type III. This is seen as a localized mass of opaque tissue along the posterior surface (fig. 10), or the equator of the lens (fig. 11), or in the region around the base of the vitreous. This tissue may or may not have visible blood vessels, and if blood vessels are present they may in time disappear. Hemorrhage may occur in the tissue. If the lesion is located at the equator of the lens, or in the anterior vitreous around the base, it usually is accompanied by a detachment of the retina (fig. 11) which points toward the lesion; that is, the elevated retina extends toward or into the tissue, and the retina elsewhere may be in good position. A

hole in the retina or a disinsertion may be present. Long ciliary processes point toward the opaque tissue (fig. 10). Strands or fingerlike projections may extend from the mass posteriorly to the surface of the retina (figs. 12 and 13). In one case there was a coloboma of the optic disc.

Type IV. This comprises instances wherein the central portion of the hyaloid system, or the greater part of it, remains with little or no retrolental portion (fig. 15). This group is in contrast to type III, in which a part of the retrolental portion remains but no central hyaloid portion. The hyaloid system is a part of the primary vitreous so that anomalies of the two are associated with perhaps the one or the other dominant in an individual case. Just as there may be, on the one hand, an isolated rest of the primary vitreous on the posterior surface of the
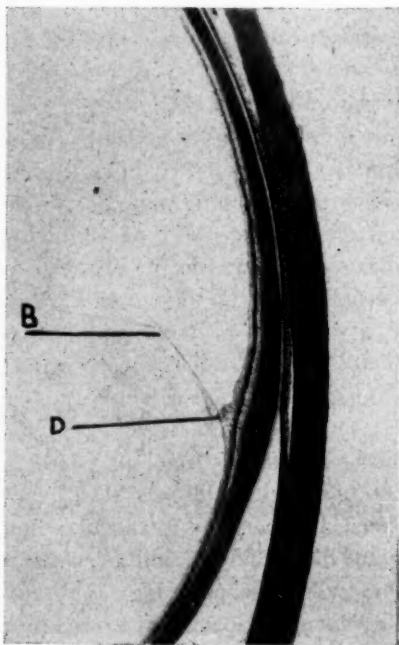
Fig. 13 (Reese and Payne). The fibrous strand shown in figure 12 at B is seen here, B, attaching to the inner surface of the retina, which it is detaching by its pull at D.

lens, so there may be, on the other hand, an isolated remain of the hyaloid artery and all combinations in between the two extremes.

In our series, two particularly interesting cases belong to this fourth type. The one was of a 17-months-old infant who in the right eye had a massive vitreous hemorrhage preventing a view of the interior of the eye. The cause of the hemorrhage could not be determined until complete absorption occurred after several months, when a persistent hyaloid artery was found. The other was a similar case of a three-year-old boy who, on having the left eye bandaged after removal of a foreign body from the cornea, noticed that he could not see with the right eye. Under ether anesthesia, the eye was enucleated with the clinical diagnosis of retinoblastoma. Pathologic examination revealed a vitreous hemorrhage and remains of the hyaloid system; no tumor was present.

In these two cases vitreous hemorrhage occurred from a persistent hyaloid artery and no doubt spontaneously, as we know this does happen in other instances where elements of the primary vitreous persist.

The incidence of the four clinical types in our series of cases was as follows:

DIAGNOSIS

Clinical type I especially can be confused with retinoblastoma. X-ray studies on nine cases were negative for calcium. Transillumination of light is good except in those cases with hemorrhage. The most important diagnostic points are (1) an opaque tissue just behind the lens with a saucer-shaped or anterior concavity; (2) long ciliary processes extending into the retrolental tissue. Retinoblastoma seldom occurs in a microphthalmic eye. Clinical type II can be confused with other types of buphthalmos or with corneal changes secondary to intraocular inflammation. Clinical type III can be confused with massive retinal fibrosis of children secondary to intraocular hemorrhage at birth.[25]

Type IV can be confused with an intraocular growth when vitreous hemorrhage occurs.

EMBRYOLOGY

The various phases of this basic lesion consist of arrested development, arrested regression, and hyperplasia of the developing vitreous. A review, therefore, of the development of the vitreous is in order.

FIRST PERIOD (up to the 13-mm. stage).

At the 4.5-mm. stage, mesoderm be-

Type I	Type II	Type III	Type IV
16 bilateral	9 bilateral	2 bilateral	
8 unilateral	1 unilateral	1 unilateral	3 unilateral

2 bilateral ....later progressed to type II

4 with type I
in 1 eye, and ...... type II in the fellow eye

2 with type I
in 1 eye, and ....type III in the fellow eye

1 with type I
in 1 eye, and ....type IV in the fellow eye

gins to appear in the space between the lens plate and optic vesicle. This mesoderm is part of the vasoformative cells which will grow in through the fetal fissure to form the hyaloid arterial system.

By the 10-mm. stage large quantities of vascular mesoderm have grown in between the lens vesicle and the inner layer (retina) of the invaginating optic vesicle, forming the hyaloid artery, which is entering the eye through the fetal fissure.

At the 12-mm. stage the vitreous is a mass of fibrils derived from the lens (ectodermal) and the retina (ectodermal) and joining up secondarily with fibrils (mesodermal) from the cells of the wall of the hyaloid artery.

At the 13-mm. stage the hyaline capsule surrounding the lens has completely formed. The lens no longer, therefore, contributes to the formation of vitreous. Vitreous fibrils, remaining adherent to the lens capsule, condense to form a thin fibrous envelope surrounding the lens and containing in its meshes the vessels of the vascular capsule. This fibrous capsule is the capsula perilenticularis fibrosa and originated from the lental part of the primary vitreous.

Development of vessels in the first period. At the 6 to 7-mm. stage the terminal part of the hyaloid artery ends near the posterior surface of the lens plate; it sends capillary branches into the meshes of the capsula perilenticularis fibrosa, forming a vascular net over the posterior surface of the lens. This is the beginning of the tunica vasculosa lentis, and is seen at the 8 to 9-mm. stage.

By the 10-mm. stage these vessels have extended anteriorly to form the lateral (equatorial), or capsulo-pupillary, portion of the tunica vasculosa lentis.

The vitreous as it now exists is known as the primary vitreous. It consists of ectoderm derived from the lens and retina, and of mesodermal vasoformative tissue

which has formed the hyaloid artery, the posterior and lateral portions of the tunica vasculosa lentis (enmeshed in the capsula perilenticularis fibrosa). The formation of the hyaloid capsule at the 13-mm. stage marks the end of the period of development of the primary vitreous.

SECOND PERIOD (12 to 65-mm. stage)

By the 16-mm. stage arterial branches arising from the hyaloid have begun to project into the freshly forming vitreous and are termed the vasa hyaloidea propria.

By the 25-mm. stage the anterior, or pupillary, portion of the tunica vasculosa lentis has formed.

Up to 40 mm. the vitreous (ectodermal and mesodermal) is still full of vessels as far as the periphery; that is, to the internal limiting membrane. The vasa hyaloidea propria have reached their maximum development.

After the 40-mm. stage the smaller vessels in the vitreous begin to atrophy, the portions nearest to the lens remaining visible the longest, with the result that the region nearest the retina becomes free of vessels. This avascular portion is known as the secondary vitreous. Its appearance is due to (1) atrophy of the proximal ends of the vasa hyaloidea propria and (2) further formation of additional vitreous from the retina as the eye enlarges.

There occur a cessation of growth of the primary vitreous and a continued increase in the amount of secondary vitreous, filling the eye as it enlarges, thus giving a relative, but not an absolute, decrease in the size of the primary vitreous.

The condensation line between the primary vitreous and the secondary vitreous forms the "wall" of Cloquet's canal. In the canal passes the hyaloid artery from the optic disc to the posterior surface of the lens.

The primary vitreous is funnel-shaped,

narrow at the disc, and wide at the lens (fig. 16).

Fate of the posterior portion of the tunica vasculosa lentis and the vitreous vessels.

After the 20-mm. stage, the caliber of the vessels decreases.

At the 60-mm. stage, the vasa hyaloidea propria are the first to show signs of regression; they shrink in caliber first at their proximal ends (at their origin from the hyaloid artery), losing connection with the hyaloid artery. Their distal ends remain attached to the vessels on the posterior surface of the lens and tend to curl up.

By 8½ months, all vessels except the main trunk have atrophied completely.

During the eighth month the main trunk of the hyaloid artery becomes impervious in its central part; atrophy proceeds more rapidly in its proximal portion, so that it loses connection with the disc and floats freely in Cloquet's canal from the posterior surface of the lens; it also tends to curl up. This portion atrophies during the first few years of life.

PATHOLOGY

We have available 17 eyes which contribute to the study of the pathologic processes concerned in the condition under discussion.

I. THIRTEEN EYES FROM THIRTEEN DIFFERENT CASES OF PERSISTENT PRIMARY VITREOUS

A. The retrolental fibrous sheath. Each eye had a fibrous sheath of varied thickness and shape behind the lens (figs. 2, 3, 4, 5, 7, 9, 12). In most instances this sheath conformed to the contour of the posterior surface of the lens but occasionally the sheath was flat and rarely protruded inward, presenting an anterior convexity instead of an anterior concav-
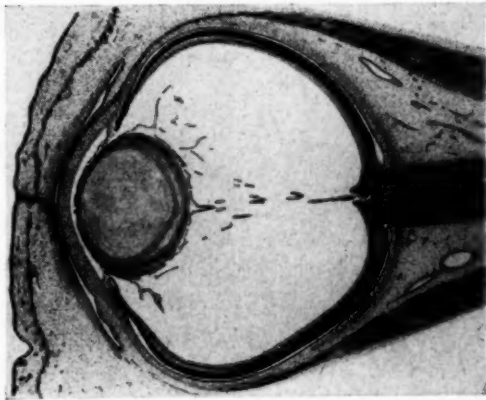
Fig. 16 (Reese and Payne). The primary and secondary vitreous of a 130-mm. fetus as depicted on Tafel XXII in Bach and Seefelder's "Atlas zur Entwicklungsgeschichte des Menschlichen Auges," 1911. The hyaloid system, together with the primary vitreous, forms a vascularized, funnel-shaped zone of mesoderm extending from the retrolental region to the disc.

ity. The sheath was composed mostly of fibrous tissue rather rich in blood vessels. In seven of the eyes there was, along the posterior surface of the sheath, a definite layer which histologically resembled smooth muscle (fig. 8, D). This was thickest at the central area, where it merged with the remains of the hyaloid system when present (fig. 3, F). The staining reaction of this tissue with hematoxylin and eosin was consistent with that of smooth muscle, but with the trichrome stain it took more of a bluish color than adult smooth muscle but less than connective tissue. In three of the eyes, the sheath contained fat (fig. 8, C); in one, large areas of cartilage (fig. 3, E); and in one, an area of tissue interpreted as undifferentiated mesenchyme. Remains of the hyaloid system were noted in four eyes. This consisted of a patent vessel extending from the disc to the posterior central portion of the fibrous sheath. Very long slender ciliary processes extended to the periphery of the sheath in all eyes. These processes were enmeshed in the periphery
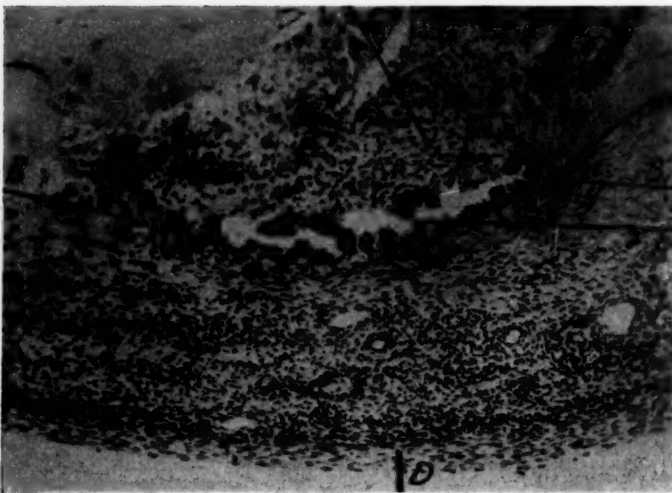
Fig. 8 (Reese and Payne). A higher magnification of the site from B to B₁ in figure 7. The opening in the capsule extends from B to B₁. The darker areas, A, represent calcium. The region designated C is fat, and the layer shown at D is smooth muscle. There are a considerable number of vascular channels.

of the retrolental fibrous tissue either on one or both sides of the sections, and in five eyes the retina also. In one eye (figs. 12 and 13) a fibrous strand coursed from the fibrous sheath across the vitreous cavity to the surface of the retina, where traction probably from contracture caused a detachment of the internal limiting layer of the retina (fig. 13, D). In two eyes there was evidence that the membrane had grown; in the one it had extended along the anterior hyaloid membrane for a short distance and in the other it had extended into the lens substance as papillary ingrowths.

B. The lens. The posterior lens capsule was open in seven eyes (figs. 7 and 8). In two eyes in which this was not seen, the capsule was thrown into wrinkles or folds, apparently from the contracture of the fibrous sheath along its posterior surface. This may explain the mechanism by which the capsule is broken. The subcapsular epithelium extended under the posterior capsule in multiple layers in five eyes and in one eye around the region of the broken capsule this epithelium had proliferated. Apparently from the opening in the posterior capsule the cortical area of the lens was cataractous in seven

eyes (fig. 7) and in one eye (fig. 3, C) there was an anterior polar cataract seen as a pyramidal-shaped extension due to proliferation of the subcapsular epithelium. In the cataractous cortical material large lens cells were present in two eyes. Other changes consequent to the opening in the posterior capsule were swelling of the lens and mild inflammatory reaction in the fibrous sheath adjacent to the opening, including some phagocytes containing soft lens matter. The lens in six of the eyes was definitely smaller than normal (fig. 2) and three of these were kidney-shaped, with the concavity directed posteriorly (fig. 3). In four eyes a portion of both the lens and iris were in contact with the posterior surface of the cornea (figs. 7 and 9), causing corneal changes consisting of edema, some infiltration by leucocytes, and early pannus formation. In one of these eyes the lens was dislocated into the anterior chamber and in another a swollen cataractous pyramidal-shaped lens protruded through the pupillary area to the cornea.

C. The retina. In eight of the eyes the retina was in place, appeared to have all of its elements, and no reason could be noted organically why it should not be

Fig. 4 (Reese and Payne). A section of a human eye showing persistence and hyperplasia of the primary vitreous corresponding to clinical type I. The retrolental fibrous tissue at A extends down into the funnel, B, of the detached retina, C. D represents subretinal hemorrhage, and E a retinal cyst. Elongated ciliary processes, F and F_1, extend into the retrolental tissue. The retina is composed of undeveloped embryonic tissue with true rosettes at G and elsewhere. This represents an instance wherein the secondary vitreous has failed to form.
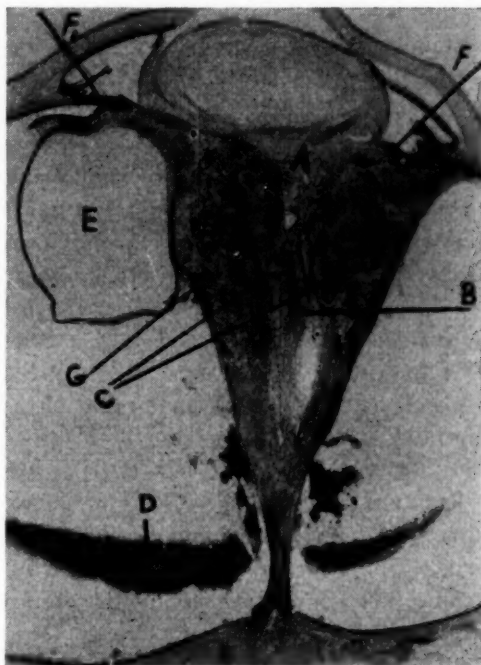
capable of functioning. In one eye the retina although in place was definitely malformed, as evidenced by a deficiency in the nuclear elements, rods, and cones. In five of the aforementioned nine eyes the retina proper extended together with the ciliary processes into the periphery of the retrolental fibrous sheath (figs. 2 and 3). By contracture of the sheath the processes and retina seemed to have been drawn more and more toward the sheath. In only one eye had this process led to a slight detachment of the retina. This was only a small slit seperation in the periphery on one side. In most instances the ciliary processes and retina were enmeshed in the sheath only on one side, which was usually the nasal side. In three of the nine eyes the ora serrata of the retina extended to the base of the iris or to the ciliary processes on one side.

There were five eyes in which the retina was completely detached funnel-fashion, with the retrolental fibrous tissue occu-

Fig. 5 (Reese and Payne). A section of a human eye showing persistence of the primary vitreous corresponding to clinical type I. This is the left eye of a three-day-old premature girl obtained at autopsy. The persistent primary vitreous, A—A_1 extends down into the funnel of the detached embryonic retina, B—B_1, which contains true rosettes, C. The separation of the lens, D, from the retrolental fibrous tissue is an artefact. This represents an instance wherein the secondary vitreous has failed to form. The right eye was of normal size and microscopically showed persistence of the primary vitreous, including the hyaloid artery.
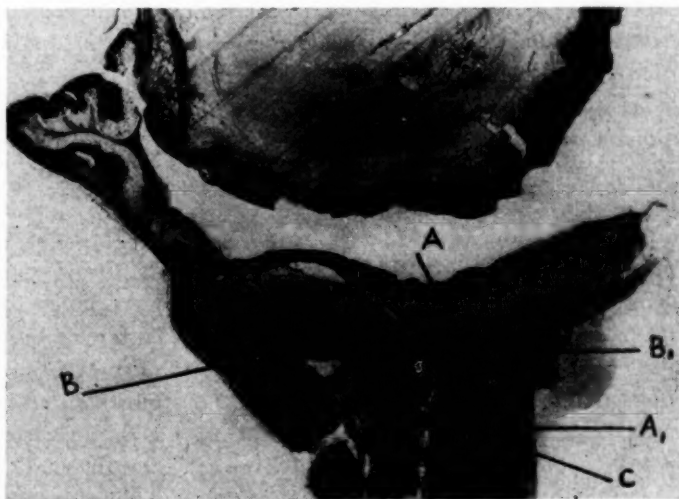
pying the base and extending varying distances into the funnel (figs. 4 and 5). These five globes had identical pathologic changes and really constitute a distinct group. They are characterized by embryonic retina as a solid mass of tissue just behind the retrolental fibrous sheath. In this retinal tissue true rosettes were seen in four of the eyes and calcium deposit in three; four of the eyes showed subretinal hemorrhage which was of a massive nature in two; four of the eyes showed malformed and embryonic filtration angle, ciliary body, and iris. One of these cases (fig. 5) was of a 3-day-old premature girl, weighing 2,460 gm., whose eyes were obtained at autopsy. The right eye was of normal size and microscopically showed persistence of the tunica vasculosa lentis and some primary vitreous, persistence of the hyaloid artery, coloboma of the iris, pupillary membrane, retinal folds, and ciliary processes on the posterior surface of the iris. The left eye microscopically showed microphthalmos, persistence of the primary vitreous, embryonic detached retina with rosettes and calcium deposition, coloboma of the iris, pupillary membrane, and ciliary processes on the posterior surface of the iris. The autopsy findings were prematurity, congenital abnormalities of the heart (atrophy and stenosis of the pulmonary artery, hypertrophy of the ductus arteriosus, partial defect of the ventricular septum, right transposition of the aorta, and congenital dilatation and hypertrophy of the right side of the heart), congenital absence of the right hypogastric artery, congenital fracture of the right parietal bone, cranio tabes, congenital emphysema, congenital abnormality of the eyes, papilloma of the tongue, partial cleft palate, acute omphalitis, polydactylism of the right hand and both feet, physiologic jaundice, Meckel's diverticulum, accessory lobe of the spleen, accessory lobe of the liver, uric-acid infarcts of the kidneys, bicornate uterus, and bilateral club feet.

These five eyes seem to represent instances in which the secondary vitreous failed to form. To summarize, therefore, this is a subgroup characterized by a persistence of the primary vitreous and failure of the secondary vitreous to form, detached embryonic retina, later perhaps subretinal hemorrhage, and frequently glaucoma. It may be that hemorrhage of the primary vitreous with organization and contracture also plays a part.

D. The iris and ciliary body. Some degree of pupillary membrane was noted in six of the eyes. (fig. 3). Both the iris and the ciliary body were rudimentary or underdeveloped in seven eyes and to a lesser degree in several others. As previously stated, the iris along with the lens was in apposition to the posterior surface of the cornea either in part or totally in four eyes. Peripheral synechiae were present in five eyes. The filtration angle was embryonic or underdeveloped in five eyes.

E. Glaucoma. There was histologic evidence of glaucoma in six eyes—peripheral synechiae in five, cupping of the disc in one, and hydrophthalmos in three.

II. Two EYES FROM ONE CASE OF PERSISTENT PRIMARY VITREOUS INDICATING THE RELATIONSHIP TO HEMANGIOMA

Of twins born three months prematurely, one lived, and no abnormalities were noted except of the eyes. Clinically both eyes showed the following anomalies (fig. 1): the anterior chambers were almost absent and behind each lens there was a vascular, white, saucer-shaped sheath, and long ciliary processes were visible around the periphery. The diagnosis of persistent primary vitreous of each eye was made.

The other twin, who weighed 1 lb. 10 oz. at birth, showed, when several weeks old, an exophthalmos of the right eye. Examination of the interior of this eye showed a detachment of the retina above, with impaired transillumination over the detached area. Examination of the left eye was negative. After many attacks of cyanosis with cessation of respiration, the infant died, and an autopsy was performed.

The autopsy findings were as follows: prematurity; hemangiomata of the pharynx, carotid body on the right side, orbit on the right side, both retinas and adjacent vitreous, and choroidal plexus of the fourth ventricle; exophthalmos on the right side; extramedullary blood formation in the spleen, liver, adrenals, kidneys, and lymph nodes; splenomegaly; jaundice; lobular pneumonia of the right lower lobe; accidental involution of the thymus gland; accessory adrenal gland attached to the fallopian tube; and patent foramen ovale.

Microscopic examination of the eyes showed:

Right eye (fig. 14): The retina is detached over one half of the globe and there is a tear at the ora serrata which may be an artefact. Over the surface of the retina, and particularly of that portion detached, there are many blood vessels without much supporting tissue extending from the nerve head to a point just behind the ora serrata. These vessels and their supporting tissue are attached to the inner surface of the retina. There is some vitreous hemorrhage, which apparently came from the epiretinal vessels. The hemorrhage has become partially organized and the contracture of this, perhaps together with the supporting fibrous tissue of the vascular layer along the retinal surface, has led to detachment of the retina. At no point can excessive blood channels be seen in the fiber layer of the

retina. The filtration angle is embryonic in type.

Behind the globe there is a large non-encapsulated hemagioma (fig. 14, D containing large blood-filled sinuses sur-
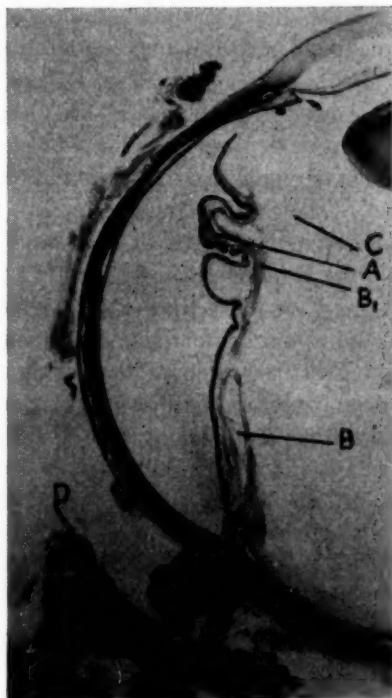
Fig. 14 (Reese and Payne). The section of an eye of a three-month-old premature girl obtained at autopsy. The lesion corresponds to clinical type III. The twin of the patient lived and has typical clinical type-I lesions in each eye (see figure 1). Over the surface of the detached retina, A, is hemangiomatous tissue, B and B_1, in which is some hemorrhage. Contracture has detached the retina and thrown it into folds. A strand of fibrous tissue, C_1 extends from the hemangiomatous tissue to the posterior surface of the lens. D shows a portion of a typical hemangioma of the orbit which produced proptosis. The fellow eye showed a layer of flat, hemangiomatous tissue along the surface of the retina (see autopsy findings in text).

rounded by hyperplastic endothelial cells.

Left eye: The retina is in position, but along its entire surface there are small blood vessels either as a thin layer or as localized clumps, with relatively little sup-

porting tissue. These same vessels are also seen anterior to the nerve head. In places these vessels over the retina lie along the surface of the internal limiting membrane while elsewhere they appear in the nerve-fiber layer. Some vessels parallel the surface while others course obliquely or perpendicularly to the surface.

The angles are embryonic and the iris stroma appears more vascular than usual. The surface markings of the iris are obscured by a vascular tissue.

Pathologic diagnoses of eyes and adnexa were hemangioma of the right orbit; detachment of the retina of the right eye due to vitreous hemorrhage, organization and contracture from a hemangioma of the primary vitreous and vascular layer of the retina; and hemangioma of the primary vitreous and vascular layer of the retina of the left eye.

III. ONE EYE WITH A PERSISTENT HYALOID ARTERY FROM WHICH A SPONTANEOUS VITREOUS HEMORRHAGE OCCURRED

This is the globe removed from the three-year-old boy described under clinical type IV.

IV. ONE EYE OF A RED SETTER PUPPY SHOWING PERSISTENCE AND HYPERPLASIA OF THE PRIMARY VITREOUS

A white reflex was seen through the pupil and the eye was enucleated with the idea that the lesion might represent a retinoblastoma. Microscopic examination showed the typical lesion representing clinical type I.

ETIOLOGY

It is our belief that the lesion represents the congenital remains or persistence of embryonic tissue and, therefore, is not essentially an acquired one. Sixty percent of our cases occurred in premature infants. We are inclined to believe that the same factor which precipitates early birth may also cause the eye lesions. Infection as the cause of congenital defects is receiving special attention now, due to the accepted connection between maternal rubella during pregnancy and congenital anomalies of the offspring; also toxoplasmosis may occur apparently in a subclinical form in the pregnant woman and produce congenital eye defects as well as choroiditis in the offspring, which may be born prematurely. One of our cases was of a premature boy whose right eye showed persistence and hyperplasia of the primary vitreous (clinical type I). The left eye, which was of normal size, showed an area of juxtapapillary choroiditis not unlike that caused by the toxoplasma.

We do not have convincing evidence indicating that the lesion occurs as the result of maternal infection. We obtained in 12 of the mothers a history of uterine bleeding ranging from the second to the eighth month. The duration varied from a day to several months. Three of the mothers with uterine bleeding also had upper-respiratory infections, with fever, and two mothers without uterine bleeding also had what was thought to be upper-respiratory infection.

TREATMENT

Surgery has been necessary for glaucoma 12 times. Iridencleisis, cyclodialysis, trephining, and iridectomy with sclerectomy have been tried; iridencleisis seems to be the most effective. The iris is usually friable, and a keratome section must be placed accurately because of the shallow anterior chamber. Because accurate examination, including tonometric readings, are not possible without general anesthesia valid results of the glaucoma surgery cannot be given.

On the premise that the retina seems

capable of functioning, judging by the microscopic examination of these eyes, an effort has been made to salvage vision in six eyes of six patients. The object has been to remove the lens substance by repeated discissions and finally to make a vertical cut in the retrolental fibrous tissue with de Wecker's scissors. When the discission is done the lens substance tends not to become opaque, swell, protrude into the anterior chamber, and be absorbed. Very little seems to happen when the lens capsule is opened. The capsule opening, therefore, can be made very extensive without fear of undue swelling. After it was thought that the lens substance had been dissipated for the most part, then a central vertical incision was made through the remaining tissue with de Wecker's scissors. This maneuver was followed by hemorrhage which filled the anterior chamber, but absorption took place in due time. In one instance three discissions and two incisions with de Wecker's scissors were necessary. In 2 of the 6 cases the mother states that the baby can pick up objects and believes this vision comes from the eye that was operated on. These procedures have never left the pupillary area completely clear, and leave much to be desired.

We intend to try irradiation on some of the selected cases as soon as the patients are older.

DISCUSSION

We have deduced from the clinical and pathologic findings that the basic lesion is a persistence in part or *in toto* of the primary vitreous (fig. 16) with or without hyperplasia and with or without secondary changes consequent to hemorrhage, opening of the lens capsule, and glaucoma. As the primary vitreous is mesenchyme it is not surprising that the various tissues into which the mesenchyme can develop are seen in the hyperplastic retrolental

tissue, to wit: fat, cartilage, smooth muscle, blood vessels, and connective tissue. Haden,[26] in his description of the embryology of the vitreous, states: "Toward the end of fetal life very little of the primary vitreous remains. Sometimes, however, this primary vitreous fails to absorb and the mesodermal part develops into fibrous connective tissue, and a firm, triangular, opaque mass is formed behind the lens. Ophthalmoscopically, this mass has been diagnosed as glioma of the retina."

There is a tendency for hemorrhage to occur in the persistent primary vitreous, and this may lead to organization, contracture, and their attendant sequelae. There is also frequently an opening in the posterior capsule of the lens, and this leads to cataract with lens swelling and perhaps some inflammatory changes. The corneal changes seen in clinical type II are due primarily to the entrance of aqueous into the stroma, caused by the contact of a portion of the lens and iris with the posterior surface of the cornea but augmented by the presence of glaucoma.

There seems to be evidence to indicate that the formation of the secondary vitreous plays a role in some of the pathologic findings. If fibrous strands of the primary vitreous remain adherent to the inner surface of the retina, then, when the secondary vitreous forms, the retina may be detached. All degrees of this process may be seen, even to the point where the primary vitreous is adherent to the entire inner surface of the retina and the secondary vitreous either fails to form or forms sparingly, with complete detachment of the retina.

There seems to be some relationship of the lesion under discussion to hemangioma. The primary vitreous is, for the most part, angioblastic mesoderm, and in some areas of microscopic sections

studied the retrolental tissue showed highly vascularized areas not unlike hemangiomatous tissue. Most hemangiomas encountered over the body are viewed as having their origin from congenital rests of angioblastic mesoderm. Basically, therefore, the relationship exists, and this is borne out by both our clinical and pathologic findings. We noted hemangiomatous lesions of the skin of the face, scalp, body, or extremities in seven of our cases. We also had a case with the clinical type I lesion associated with microphthalmos on one side and on the other side hydrophthalmos due, we thought, to hemangioma of the choroid together with a hemangioma of the skin of the upper lid. Furthermore, in describing our pathologic material we cited the autopsy findings in an infant with hemangioma of one orbit, both retinas and adjacent vitreous, and elsewhere over the body, whose premature twin had typical clinical type I lesions of both eyes. The fact that the basic lesion in both the persistence of the primary vitreous and in hemangioma consists of congenital remains of angioblastic mesoderm makes the two conditions fundamentally related.

References

[1] Howard, H.   Further proof of the vascularity of the lens and its capsule. Brit. Amer. Jour. Med. and Phys. Sci., 1851-2, v. 7, pp. 150-153.

[2] Nettleship, E.   Vascular cord traversing vitreous and coexisting with great plastic inflammation of hyaloid. Roy. Lond. Ophth. Hosp. Rep., 1873, v. 7, pp. 632-637.

[3] Gardiner, E. J.   A case of persistent hyaloid canal and artery. Arch. of Ophth., 1880, v. 9, pp. 473-474.

[4] Collins, E. T.   Pseudoglioma. Roy. Lond. Ophth. Hosp. Rep., 1892, v. 13, pp. 361-394.

[5] Pollock, W. B. I.   Case of pseudoglioma due to persistence and thickening of the posterior fibrovascular sheath of the lens. Trans. Ophth. Soc. United Kingdom, 1923, v. 43, pp. 263-272.

[6] Parsons, J. H.   Microscopical section of pseudoglioma, due to congenital membrane behind the lens. Trans. Ophth. Soc. United Kingdom, 1902, v. 22, pp. 253-254.

[7] Bruckner, A.   Ueber Persistenz von Resten der Tunica vasculosa lentis. Arch. f. Augenh., 1907, v. 56, pp. 5-149.

[8] Lane, F.   Persistent posterior fibrovascular sheath of the lens. Arch. of Ophth., 1919, v. 48, pp. 572-580.

[9] Lent, E. J., and Lyon, M. B.   Persistence of embryonic fibrovascular sheath of the crystalline lens. Amer. Jour. Ophth., 1922, v. 5, pp. 706-711.

[10] Gifford, S. R., and Latta, J. S.   Pseudoglioma and remains of the tunica vasculosa lentis. Amer. Jour. Ophth., 1923, v. 6, pp. 565-571.

[11] Lloyd, R. I.   Pseudoglioma, with special reference to the type associated with remains of the tunica vasculos. Amer. Jour. Ophth., 1931, v. 14, pp. 27-33.

[12] Fuchs, E.   Pseudophakia fibrosa of Czermak. In "Textbook of Ophthalmology." Ed. 7, Philadelphia, Lippincott, 1923, p. 650.

[13] Collins, E. T., and Mayou, M. S.   Opaque membrane behind the lens. In "Pathology and bacteriology of the eye." Ed. 2, Philadelphia, Blakiston, 1925, p. 45.

[14] ———.   Shrunken fibrous tissue cataract. Ibid., p. 47.

[15] ———.   Posterior lenticonus. Ibid.

[16] ———.   Congenital connective tissue formation in the vitreous chamber. Ibid., p. 64.

[17] Mann, Ida.   Posterior polar cataract. In "Developmental anomalies of the eye." Cambridge Univ. Press, 1937, p. 350.

[18] ———. Fibrous tissue cataract. Ibid., p. 351.
[19] Duke-Elder, W. S. Persistence of the vascular sheath of the lens. In "Text-book of ophthalmology." St. Louis, C. V. Mosby, 1938, v. 2, p. 1381.
[20] Terry, T. L. Fibroblastic overgrowth of persistent tunica vasculosa lentis in infants born prematurely. Amer. Jour. Ophth., 1942, v. 25, pp. 1409-1423.
[21] ———. Extreme prematurity and fibroblastic overgrowth of persistent vascular sheath behind each crystalline lens. Amer. Jour. Ophth., 1942, v. 25, pp. 203-204.
[22] ———. Fibroblastic overgrowth of persistent tunica vasculosa lentis in infants born prematurely. Amer. Jour. Ophth., 1942, v. 25, pp. 262-284.
[23] ———. Fibroblastic overgrowth of persistent tunica vasculosa lentis in premature infants. Arch. of Ophth., 1943, v. 29, pp. 54-68.
[24] ———. Retrolental fibroplasia in premature infants. Arch. of Ophth., 1945, v. 33, pp. 203-208.
[25] Reese, A. B. Massive retinal fibrosis in children. Amer. Jour. Ophth., 1936, v. 19, pp. 576-582.
[26] Haden, H. C. Concerning certain phases in the development of the vitreous. Trans. Amer. Ophth. Soc., 1941, pp. 41-48.

DISCUSSION

DR. IDA MANN (Oxford). I wish first to congratulate Drs. Reese and Payne on this interesting presentation of a very careful piece of work. These cases have been recognized since the middle of the 19th century and a great variety have been described, as it is doubtful whether any two cases are completely identical. The present collection and classification bring out very well the part played in their production by the primary vitreous and also their association with other developmental anomalies. These cases are all good examples of the general principle of the production of developmental anomalies through arrest at a definite stage of intra- or extrauterine life followed by aberrant growth. This aberrant growth may lead to excess normal tissue or, by atypical differentiation of pluripotential cells, to the appearance of tissue abnormal in that situation; for example, cartilage and unstriped muscle in the posterior vascular capsule. That prematurity is often a feature of these cases is not surprising since the interference with development seen in the eye may be part of a general aberration manifesting itself both as prematurity and in various associated malformations (for example, of heart, lungs, palate, and extremities as described by Dr. Reese). The primary cause of the whole clinical picture is likely to be a maternal upset probably nonspecific in nature but specific in time. That this can happen has been shown by many experimental embryologists, and is now known to occur in man; for example, in rubella cataract and in the maldeveloped retinae of fetuses x-rayed *in utero*. I would therefore like to suggest to Dr. Reese that it would be more helpful if he would consider classifying his cases not on clinical findings alone but into groups based on the probable stage in development at which the initial arrest occurred. Judging the cases from a purely embryologic standpoint I should say his subgroup of type I begins earliest, probably at about the 15-mm. stage and certainly before the end of the organogenetic period. May I also urge in the description of this group the use of the term "failure of coaptation of the retina" in place of "detachment"?

His type III is also early, beginning certainly before the third month and is allied to congenital retinal septum, which can also be explained as a localized linear failure of secondary vitreous.

Type II probably begins between the fifth and sixth months, as there seems to be an accompanying arrest of formation of the angle of the anterior chamber, while those cases of type I which subsequently develop glaucoma arise pos-

sibly only a little later. Type IV is obviously related to an arrest at the very end of fetal life only (during the eighth month).

This classification could be checked and amplified if very accurate data could be obtained of the time of the maternal upset as evidenced by the occurrence of bleeding and of respiratory infections noted in 14 of the mothers. The cases would then probably be seen as a continuous series rather than as sharply differentiated types.

DR. HENRY HADEN (Houston, Texas). Dr. Reese and Dr. Payne are to be congratulated upon this comprehensive study.

I agree with them that the term persistence and hyperplasia of the primary vitreous is appropriate for the congenital abnormalities under discussion. The primary vitreous is composed of mesoderm which flows in between the rim of the optic cup and the lens, the mesoderm that accompanies the hyaloid artery as it passes through the fetal fissure into the optic cup and ectodermal fibers derived from the lens and inner wall of the optic cup.

Toward the end of fetal life the mesodermal part of the vitreous disappears, and the permanent vitreous is exclusively ectodermal in origin. Under certain circumstances a portion of the mesodermal tissue is not absorbed, and a variety of lesions such as Dr. Reese and Dr. Payne have described are the result. The size, position, and style of the lesion are influenced by the fetal age at which the normal recession of the primary vitreous ceased.

I do not see why one should look farther for the nature of these congenital anomalies. A glance at a few sections of the developing vitreous should make this clear.

DR. F. H. VERHOEFF (Boston, Mass).

I think this is a very interesting and instructive demonstration. In specimens sent me for examination by the Army Medical Museum I have seen all of the conditions described by Dr. Reese. I was particularly interested in his finding of cartilage in the tissue. In the Army Medical Museum a recent specimen, which I had believed to be unique, showed this even better than the one he demonstrated on the screen.

Dr. Reese spoke of hemorrhages occurring in some of these eyes. I should like to ask him if he has ever seen hemorrhage extending from the retrolental tissue into the lens. I have seen this in at least one case.

I think his classification is a most useful one, and in the future will prove of great assistance in the description of such cases. To follow Dr. Mann's suggestion, all he will need to do is to assign certain embryonic periods to the stages he has mentioned.

T. L. TERRY (Boston, Mass.). That Drs. Reese and Payne hold certain views in disagreement with mine is encouraging. What stimulates search for an unknown truth more than theories that are at variance! I am sure that we shall find mutual pleasure and satisfaction in working out an agreement as full understanding of the process is attained.

Their belief that the abnormal development occurs before birth is the most outstanding difference. The evidence is based on one instance in which the infant weighing 3 lbs. 5 oz. was observed on the day of birth to have the disease process well developed. Warkany has proved that the young born of rats in an extreme stage of vitamin-A deficiency develop abnormal eyes early in gestation. We have confirmed his findings. Chief among these abnormalities is the growth of mesodermal tissue in the meshwork of the tunica vasculosa lentis behind the

lens. Although such extreme depletion of vitamin A is not likely in the human, it could cause such a sequence of events. It may account for the lesion on which Reese and Payne base their conclusion of intrauterine development of the process in their most dramatic case.

The process can and does develop during intrauterine life. It has been observed in full-term infants at time of birth. I agree with Reese and Payne that this is probably a process identical with that seen in the premature infants, but I do not believe we have proof yet that they are identical. The frequency of the disease is greater the more premature the infant. The lantern slide shows graphically the increase of frequency of the process the more prematurely the infants are born. The causes of prematurity in infants with and without the ocular malady are not greatly dissimilar, and in many instances the cause is unknown. In some of the instances of spontaneous prematurity the mother had no illness and no known disability before the premature birth. I would expect the ocular defect to manifest itself at birth or very soon thereafter in premature infants nearing term, whereas in the infants weighing three pounds or less, it would not appear for weeks or even months. It is to be regretted that Reese and Payne did not indicate the stage of prematurity of each of their cases.

A routine study of the eyes of premature infants, followed from day of birth to a time when all danger of retrolental-fibroplasia development has passed, has shown me that this disease process can and does become manifest in some premature infants after birth. Dr. Stewart Clifford, who follows closely the premature infants after their incubation, has referred a case to me in which the retrolental tissue was a small opaque spot in the back of the lens resembling a giant Mittendorf's dot. In one week this opaque area had increased so that it covered perhaps half of the back of the lens, and the anterior chamber was becoming shallow. At the end of the second week the chamber was becoming more shallow. The opaque tissue covered the entire posterior lens surface. I have seen two other such cases. Clifford and I have seen other cases jointly in which the eyes looked normal at birth, but after the patients' discharge from the hospital the opaque retrolental tissue developed and the anterior chamber became obliterated, although we did not see these patients while the fibroplasia was developing. Clifford and I have not been able to determine during their incubation which premature infants will develop retrolental fibroplasia, but Clifford has shown that some 12 percent, or one out of eight, will develop it some weeks or months after birth.

When the true nature of this condition is fully understood, there will be a satisfactory explanation for isolated observations which now seem in conflict. As has been said often, full-term birth is, indeed, only an incident in life, but in extremely premature birth there is a tremendous revolution of physiologic processes. The organs of digestion, respiration, temperature regulation, internal secretion, and even the eyes are called upon to function. An abnormal process can be instituted by this precocious function sufficient to cause such an aberration of ocular development. Why both eyes or the eyes of both twins are not uniformly involved is another puzzling finding in the present state of our ignorance. The view that there is an external exciting cause for this abnormal development and that the most common single factor in many of the individuals who develop it is extremely premature birth produced by a variety of causes, leads to a definite ex-

perimental and investigative approach.

According to Clifford, the only associated defect is the lack of mental development present in some of these infants. The occurrence of angioma I first noted in a patient from Havana, one whom Reese may also have seen. Since then I have found angioma in 16 additional cases. I have not found any statistics showing the frequency of angiomata in infants as a whole, although I am told it is high.

A less important difference in our views is that of terminology. The disease, I believe, represents a growth of embryonic connective tissue in the mesh of the closed tunica vasculosa lentis, which, in part, concurrently or later, reopens before its lumen has become impervious. I say "reopens" because the vessels of the tunica-vasculosa-lentis system had previously been observed when the eyes of extremely premature infants were first examined and had become invisible when they stopped carrying blood. It is not a persistence of the vascular tunic in its embryonic and early fetal state in a region where no such solid tissue is ever encountered during normal development. Thus, I object to the "persistence" used in the title, which the essayists suggest. I consider primary vitreous to be the total mass of mesodermal and ectodermal syncytium between the lens and the retina up to the 40-mm. stage. That blood vessels are a part of it I do not agree, although blood vessels for a time pass through it and perhaps contribute to its early growth. When the blood vessels disappear, I do not visualize the primary vitreous changing over to secondary vitreous, but it persists throughout life as the less viscous material filling the so-called retrolental space and Cloquet's canal. In this view, Prof. Ida Mann told me she was in agreement. If it is correct to consider the hyaloid artery and tunica vasculosa lentis to be an integral part of primary vitreous, then the name "Hyperplasia of the primary vitreous" loses much of its objection to me. Primary vitreous reaches its full growth at the 40-mm. stage. Were the vitreous a perfect sphere, instead of part of a sphere, its total volume would be less than .420 c.mm. The volume of the adult vitreous approximates 4,300.00 c.mm. If the retrolental fibrous proliferation represents a hyperplasia of the primary vitreous, even though it does not permeate the entire vitreous of these small eyes, it would represent a very great hyperplasia indeed. Exception might be taken to the length of the name suggested by Reese and Payne. Of all the terms formerly used, "fibrovascular sheath" is perhaps the least objectionable, but it does not locate the disease process in any one organ of the body nor in any position in the eye, as does "retrolental fibroplasia."

That a name like "retrolental fibroplasia" is needed is shown by the frequent repetition of some such terms as "retrolental fibrous mass . . . fibrous membrane back of the lens . . . retrolental tissue . . ." occurring sometimes more than once to a page in the essay of Reese and Payne.

Because of the slow manner in which the lens material is absorbed following discussions, probably the result of reduced production and accumulation of aqueous humor in the eye, I have been eradicating the lens by a linear extraction associated with an iridectomy above and an iridectomy below in an attempt to prevent blocking of the pupil. I have used this operation only when the anterior chamber is absent, lento-corneal synechiae are present, and central corneal opacities are developing. An injection of normal saline solution into the anterior chamber demonstrated the presence of

these conditions. Careful suturing of the wound permits the retention of injected air in an attempt to prevent recurrence of the anterior synechiae. Following the operation an adequate anterior chamber is usually present.

The suggestion of irradiation to close the blood vessels in the fibroplastic tissue is a sound one which I shall try.

The essay of Reese and Payne indeed contains a great deal with which I fully concur. The quality of their illustrations deserves the highest praise.

DR. REESE (closing). We stated that our classification was purely a clinical one and adopted for convenience sake. I think Dr. Mann's idea to make the classification include the stage at which the maldevelopment in the embryo occurs is well worth while. I agree with her that the term "detachment of the retina" employed with respect to our subgroup of type I might more accurately be replaced by the term "failure of primary coaptation of the retina."

We appreciate very much Dr. Haden's beautiful sections showing the embryology of the primary vitreous and the manner in which it undergoes involution.

Dr. Verhoeff mentioned the relationship to hemangioma. I stated that our conception of a hemangioma is that it represents a congenital rest of angioblastic mesoderm which later begins to grow into a neoplasm. It does not behave like a true neoplasm clinically because angiomas do not have as a rule the capacity for unlimited growth. I tried to point out the fundamental relation of hemangiomas and this lesion and to give what evidence we have that the two may be associated.

We tried to point out what evidence we had of the relationship of the lesion under discussion and infection. We do not believe that this evidence is convincing.

We have never noted hemorrhage extending from the retrolental tissue into the lens as Dr. Verhoeff has.

We believe this lesion is congenital irrespective of whether it occurs in premature or in full-term infants. The matrix of the lesion is present at birth with varying degrees of hyperplasia subsequently. This interpretation is not based solely upon one case as stated by Dr. Terry but upon several factors. First, in premature infants the lesion was observed at birth in one case and at less than one week of age in one case; in full-term infants the lesion was noted at birth in three cases and at less than one week of age in four cases. The clinical and pathologic features appear identical in both groups. Second, the hyaloid artery, if absent at birth, never develops later; rather, if it is observed later it was necessarily present at birth. In other words, the hyaloid artery is always a congenital manifestation. The hyaloid artery is frequently associated with the condition under discussion. Third, the various tissues (connective tissue, blood vessels, fat, cartilage, and smooth muscle) seen in these lesions take origin from mesoderm. Mesoderm does not form after birth.

Dr. Terry disagrees somewhat with our conception of the primary vitreous. It seems to me our views in this regard are the ones generally advanced by the embryologists. Irrespective of names there certainly occurs in embryonic life an angioblastic mesoderm inside the eye and normally this disappears. When it persists and becomes hyperplastic we believe it gives rise to the various lesions described in this general group.

Dr. Terry refers to a case in which he observed an increase in an island of retrolental tissue resembling a giant Mittendorf dot. One of our cases (fig. 10) was perhaps similar when first observed a few days after birth. After four

years our case showed no increase in size, and the blood vessels disappeared.

Dr. Terry's case in which he observed the development of this lesion from birth is difficult to explain on the basis of our conception of the lesion. I imagine it can be explained on the ground that there was a small area of that retrolental tissue present and this showed an unusual degree of rapid hyperplasia.

If anyone plans to study this basic lesion experimentallly we think the dog might be a good medium. We base this on the fact that we have seen a typical type-I lesion in a red-setter puppy. This puppy had a white reflex in the pupil, and because of the possibility of retinoblastoma an enucleation was done. Sections showed typical retrolental fibrous tissue with a hyaloid artery.

GRADUATE TRAINING IN OPHTHALMOLOGY*

SECOND JACKSON MEMORIAL LECTURE

HARRY S. GRADLE, M.D.
Chicago

It would seem most fitting and proper that the subject of a Jackson Memorial Lecture should pertain to the question of ophthalmic education, a topic most dear to the heart of Dr. Edward Jackson. He himself lived through the era of the development of modern training, for in his early days organized teaching was nonexistent in the United States. He saw the vicissitudes and struggles of the early aspirant for ophthalmic training, and he saw the gradual emergence of ordered American ophthalmology from the chaos of the last century.

Before the turn of the century there was no formalized training in ophthalmology in the United States. True it is that many a good ophthalmologist was developed during those days, but it was by preceptorship, in the more or less haphazard clinics of that day, or in private offices, supplemented by personal nonsupervised reading. The amount of training that a man could obtain depended upon his personal energy and ambition.

The more fortunate journeyed to Europe, to the clinics of Vienna, Berlin, Paris, and London. In many instances they were lucky enough to obtain volunteer assistantships for one or more years, but in the majority of cases they merely observed the work as it was performed by the regular personnel of the clinic. These clinics were fairly well organized, and the native men obtained their training in ophthalmology by serving as assistants for 5 to 10 years. But still there was no formalized course of training in ophthalmology, here or elsewhere.

The foreign study and the influence of the foreign clinics became manifest here about 1900. In many of the large cities ophthalmic clinics had been in operation for 30 or even 40 years, but they were not well organized, and the majority required assistantships or internships in both eye and ear, nose and throat. In fact, in practically all of the universities those chairs were combined, as they were in the clinics. But the spirit of ophthalmology was becoming apparent in the rank and file, and that spirit demanded adequate didactic and clinical facilities for its expression. Nor could that spirit be denied, and during the next 15 years the develop-

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*This lecture was to have been read before the 1945 meeting of the American Academy of Ophthalmology and Otolaryngology, which was cancelled on account of the National Emergency.

ment of ophthalmic clinics and ophthalmic residencies progressed with startling rapidity. Ophthalmology became divorced from otolaryngology and succeeded in freeing itself from the dominating influence of its big brother, general surgery, so that the chair of ophthalmology in the medical schools became a separate entity. But still there was no formalized training in ophthalmology.

Then came the advent of the American Board of Ophthalmology, formed jointly by the three national societies, for the purpose of introducing standards into the training and practice of the specialty. Some years elapsed before the Board realized its importance, and formulated its aims, but almost overnight its educational influence became manifest. The requirements set up tentatively by the Board gave the ophthalmologic candidates a definite idea as to the course of study it was necessary to pursue; an idea that in the past had been a mere will-o-the-wisp. They perceived the goal of a completely rounded ophthalmologic education, and although formalized and supervised training was still lacking, they were able by industrious reading to form a fairly solid foundation upon which to build clinical training.

Gradually, formalized training began to make its appearance here and there. In one clinic, a course of lectures would be given upon basic subjects, while in another the clinical aspects were treated didactically as well as practically. A postgraduate school developed a course of training in ophthalmology in which didactic and laboratory work was given simultaneously with some clinical training. And so under the influence of the Board the progress has been continuous, and throughout the country more and more opportunities are being developed for serious training in ophthalmology—training that will fit a man to become a safe and sound special-

ist, upon whom his people and his colleagues can rely.

Still the opportunities for formalized training in ophthalmology are below the nation's requirements. It has been estimated that a minimum of 200 ophthalmologists a year are required to maintain the present quota; but it is also agreed that the current number of qualified ophthalmologists, certificated or otherwise, is far below the number required by the population of the United States. At present the opportunities for thorough training in ophthalmology, basic, didactic, and clinical, number about one quarter of the requirements. Another half obtain training through clinical residencies, but without basic or didactic instruction. The remainder pick up what they can.

To the American Board of Ophthalmology is due unstinted praise for its efforts and accomplishments. But the Board is ever-changing, and although universally recognized, it has no authoritative standing or academic backing. So it would seem that the time has come to incorporate the achievements and work of the Board into such form as to insure perpetuity for the ideals and accomplishments that have done so much to advance ophthalmology in this country. Such solidarity can be attained only through academic connections, and to that end it would seem fitting and proper that the gap that exists between requirements for graduation from the medical school and the certification by the American Board of Ophthalmology be filled by the university. Upon the university should fall the responsibility for formalized training in ophthalmology for a sufficient number to fill the needs of the country.

In general, formalized education in the universities is held at two main levels, the undergraduate school culminating in a Bachelor's degree and the graduate school culminating in a Doctor's degree. Above

that level the universities offer training only on a research or a personalized basis.

During the past 25 years the need has arisen for a third level of university training, particularly as it pertains to medicine and the medical specialties. This level should cover the period between completion of the general internship and the completion of training required by the specialty boards. That period of training, which, in the majority of cases, is now more or less haphazard, is definitely a function of the universities, and when assumed by them will take on a systematized character more or less standardized, as is the present work in the undergraduate medical schools.

The gap that exists between the completion of the year of interneship and the attainment of the certificate of the Board is at present the major deficit in ophthalmic education, and there is no uniformity in the endeavors of the various institutions to fill that gap. One offers a one-year clinical residency without didactic training in any of the basic sciences; another considers a two-year clinical residency with a minimum of basic-science training sufficient; while at the other end, is the five-year residency with complete and adequate basic training. Because of the chaos that exists under the present system, or lack of system, it is very evident that the gap should be filled under university jurisdiction and that a certain degree of uniformity in ophthalmic training on a nationwide basis should be introduced. Regimentation should, of course, be avoided, but a formalized curriculum could serve as a basis for training which would be varied in the universities and their associated institutions according to existent facilities.

Let us see how such a plan might function in our own specialty of ophthalmology, a specialty which is probably best prepared to institute a regular university program of graduate teaching.

It must not be forgotten that there are two classes of men who demand training in ophthalmology: those who intend to pursue an academic career of investigation or teaching, and those who intend to devote themselves to the clinical practice of ophthalmology. The first group is small in number and can be handled adequately by each institution as the case arises, and consequently requires but scant attention here. The second group outnumbers the former by a hundred to one, and hence requires more intensive study and more extensive facilities. To that group are dedicated the following pages.

Before acceptance of a student into the training realms of ophthalmology, rather extensive psychologic and psychometric tests are in order, to prove the fitness of the candidate for the specialty. Included should be tests for manual dexterity, the *sine qua non* of an ophthalmic surgeon. Good vision, normal color perception, and perfect stereopsis are even more essential to the art of eye surgery than they are to the piloting of an airplane.

Upon completion of the general interne year, a period of instruction in the basic sciences so requisite to a well-grounded ophthalmologist, should follow. It should be given within the university walls and be operated as a regular class of the medical school. The length of time would, of course, vary with different institutions, but in no case should it be less than three months nor more than six. The course should be an elaboration into detail of the basic sciences of ophthalmology as taught to the undergraduate medical student, and to that end would require a mixed faculty. The general aspects of anatomy, physiology, optics, chemistry, and bacteriology should be presented by the undergraduate teachers of those subjects in the undergraduate laboratories, whereas the application of those subjects

in the realm of ophthalmology should be presented by clinical ophthalmologists who have devoted special attention to those sciences. Lectures should play but a small role in such instruction, and the major pedagogic methods should be those of laboratory demonstrations and directed conferences and quizzes. The study of pathologic anatomy should be instituted toward the end of such a basic course, for there should be no contemplation of clinical ophthalmology until after conclusion of the basic course.

The candidates are then ready to enter the period of clinical training, which should be not less than two years. Obviously, the university hospitals cannot accommodate the total number, and extramural expansion is necessary. That can be accomplished by bringing into the fold such nearby general hospitals as offer an adequate residency in clinical ophthalmology, and supplementing that clinical work with university instruction. For example, there are in Chicago six large general hospitals that have clinical residencies in ophthalmology of one year each, one man at a time. These should take two residents for two years each, staggered so as to provide a senior and a junior, who have gone through the basic course at the university. The university hospitals in Chicago can take eight residents per year, with the result that each basic course would have 20 candidates.

Whether the resident were serving in the university or in an affiliated hospital, the instruction should be the same, and should be given in the early evening after the clinical work for the day is finished. At least once, and preferably twice, a week the group should assemble at the university for clinical or pathologic conferences or seminars. For such conferences, held under the direction of experienced clinical teachers, a two-year program should be prepared in advance, and

the junior group and the senior group should be kept separate; otherwise one year would be merely a repetition of the preceding. At each conference the prescribed reading for the next conference should be given, and thus each resident could prepare himself in advance. The conferences and seminars should embrace the clinical aspects of ophthalmology from beginning to end, borderline topics, the relationship of ophthalmology to other medical specialties, and social and preventive ophthalmology. Pathologic conferences should be held at least once a week under the ophthalmic pathologist, and each resident should be given prepared sections and clinical histories of cases, upon which he should present a prepared report at later conferences. Those studies should continue uninterruptedly throughout the entire two years of clinical residency.

Upon conclusion of the two years' clinical residency with its associated factors, a comprehensive oral and clinical examination should be given the residents by the combined staffs of the university and affiliated hospitals, including demonstrations of surgical ability upon animals and patients. Successful completion of such examination should entitle the resident to a higher degree, possibly Doctor of Science in Ophthalmology, and the automatic award of the certificate of the American Board of Ophthalmology, whose examinations would then be confined to men whose training had been other than the prescribed university course.

Now let us see what this would do for the training program on a nationwide basis. As of December, 1941, there were opportunities for approximately 180 men to be trained each year in ophthalmology, of whom about one third received adequate basic and didactic instruction, the remainder receiving clinical training only.

Under the proposed plan, at least 35 of the Class A medical schools could and probably would participate, taking in a class of 10 to 20 men each year. That would mean 400 to 700 men adequately trained in ophthalmology each year, as contrasted with the figure just quoted. Of the 3,500 or more approved hospitals in the United States, sufficient clinical residencies in ophthalmology can be developed to take care of the extramural aspects of the program.

Approval of this plan by the American Board of Ophthalmology and by the various teaching institutions could lead to an early establishment of this or some similar system. The University of Illinois has authorized the Department of Ophthalmology to set this plan into operation as soon as the teaching members of the ophthalmic staff are released from military service and full ophthalmic residencies are again functioning. Thus it becomes very possible that within the course of a few years, there may be attained the adequate formalized training in ophthalmology of numbers sufficient to supply the needs of the country, fulfilling the hopes of our great teacher, the late Edward Jackson.

58 East Washington Street (2).

REPORT FROM THE WILMER INSTITUTE ON THE RESULTS OBTAINED IN THE TREATMENT OF MYOPIA BY VISUAL TRAINING*

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The purpose of this paper is to report the results of an investigation on the effect of visual training in uncomplicated myopia. The participation of the Wilmer Institute in this investigation was limited solely to examination of the patients before the beginning of the training, and again after the training had been completed. The pre- and posttraining examinations were made in the Wilmer Institute by staff members under the direction of Dr. Frank B. Walsh. The training program itself was conducted in another part of Baltimore, remote from the Johns Hopkins Hospital, under the direction of Dr. A. M. Skeffington, Director of the Graduate Clinic Foundation of Saint Louis, Missouri, and his associates. The Wilmer Institute therefore acted solely as a judge of the effect obtained, and so acted without either endorsement or condemnation of the visual training conducted by Dr. Skeffington and his associates. The background leading up to this investigation was as follows:

In the spring of 1944, the Curtis Publishing Company, through the agency of Mr. Bruce Gould, offered to finance an investigation on the merits of widely publicized methods of visual training in the treatment of myopia. The fundamental idea of this investigation was to collect a suitable group of patients with uncomplicated myopia, have their visual acuity and refraction errors determined prior to the course of visual training, and at the conclusion of such training have the patients examined to determine if any demonstrable improvement in the vision or underlying myopia had occurred. To this end Mr. Gould proposed to bring to Baltimore several leading advocates and exponents of the training therapy, which

gentlemen would establish a clinic in Baltimore where such treatment could be properly pursued. The Wilmer Institute was requested to act as judge of the results obtained. After preliminary discussion, the Wilmer Institute accepted this proposition under the following specific conditions:

The candidates for training would be recruited by Dr. Skeffington and his associates, and sent to the Wilmer Institute for a preliminary examination. After this examination candidates showing any ocular pathologic change or who did not appear suitable for such treatment would be rejected by the examining physician in the Wilmer Institute. The nature of the eye examination to determine the visual acuity, refractive error, and the like, was entirely at the discretion of the staff of the Wilmer Institute, with the agreed stipulation that recognized standard tests and standard illumination would be employed. The results of the preliminary examinations were not to be transmitted to Dr. Skeffington or his associates, but were to be filed with the Curtis Publishing Company. The selected patients would then be given such visual training as Dr. Skeffington and his group believed proper, the staff of the Wilmer Institute having no knowledge of the type or extent of such training. On the completion of the course of visual training, the patients would be returned to the Wilmer Institute for a second examination. In certain cases, notably when some improvement was noted, the patients might again be returned to the Wilmer Institute for a third examination to determine whether the observed improvement was maintained. It was agreed that the results of these examinations should be tabulated and reported by the Director of the Wilmer Institute in a recognized medical periodical before they were reported or referred to either by the Curtis Publishing Com-

pany or Dr. Skeffington's group. The Wilmer Institute received no financial support of any kind from the Curtis Publishing Company or any other agency. These conditions were agreed to by the Curtis Publishing Company, by Dr. Skeffington's group, were approved by several leading ophthalmologists who were consulted, and the investigation was undertaken.

Accordingly, in September of 1944, Dr. Skeffington and his associates moved to Baltimore and established a clinic in the downtown section of the city. The patients for examination were recruited chiefly from the public schools of Baltimore, with the inclusion of a few private patients and nine candidates who were midshipmen from the United States Naval Academy in Annapolis. These patients were then sent to the Wilmer Institute for examination, and 103 were selected as having uncomplicated myopia and being proper candidates for training. The patients were then returned to Dr. Skeffington for training. On the completion of the training they were then returned to the Wilmer Institute for the posttraining examination. The training clinic continued in operation until December of 1944. The final, third examinations on the patients showing improvement were completed in May of 1945.

TECHNIQUE OF EYE EXAMINATION

First examination. Each patient referred to the Wilmer Institute as a candidate for training under this program was subjected to the following examinations.

1. Determination of the visual acuity without correction of each eye at 20 feet or a shorter distance when necessary. Four charts were used for this purpose: (a) Snellen chart with letters, (b) Snellen chart with numbers, (c) Landolt broken-ring chart, and (d) Snellen letter-E chart. In this examination, as in all tests of

visual acuity, the individual was required to declare that smaller objects could not be seen, or must consistently make comparable errors in stating what was seen. The amount of illumination was between 24 and 26 foot candles, and this was constantly checked.

2. A cycloplegic was then instilled in the eyes. Two instillations of 5-percent homatropine were used in individuals nine years or over. Atropine sulfate, 1 percent solution three times a day for two days, was used in younger individuals. The eyes were then retinoscoped and the static refraction was determined.

3. A general external and ophthalmoscopic examination was made to rule out any ocular pathologic process.

Second examination. The visual acuity without correction was again made on the four separate charts as in the first examination. In 67 instances further retinoscopic determination was made.

Third examination. The visual acuity without correction was determined as in the first two examinations.

TECHNIQUE OF VISUAL-TRAINING PROGRAM

The visual-training program which these patients received is summarized by Dr. Skeffington as follows:

"The visual training rests on the postulate that seeing is a learned act and is therefore susceptible to training. A system of differential analysis was employed to discover the type of distorted pattern resulting from undesirable visual practices. Spheres, cylinders, prisms, and targets were employed in this training program with the idea of reorganizing the visual behavior patterns that the visual skills, including acuity, can be improved significantly. This method of visual training has neither in theory nor practice any relation to the so-called Bates theory, and in theory and practice it involves no deviation from the known and accepted theories

and facts of physiology and neurology of the eye or the experimental psychology of vision. It has its inception in the work of optometrists, stemming from the standard literature on learning. The records of this development from its start exist in the optometric literature, and are covered in the papers of Drs. George Crow and Harry Fuog, S. K. Lesser, Leslie B. Burdette, Marguerita Thoma Eberl and others, in the Optometric Extension Program, articles on training in the files of the Optometric Weekly, the American Journal of Optometry, and other publications."

TABULATION OF RESULTS

The full information on every patient is contained in the final table IX. It will be noted that there were marked fluctuations in the visual acuity of the majority of the patients on different charts. It was impossible to average these different visual acuities on the Snellen scale. Therefore, each observation on the Snellen scale was reduced to percentage visual acuity, using the tables computed in Dr. A. C. Snell's book on "Medico-legal ophthalmology." The pre- and posttraining visual acuity was arrived at by taking an average of the percentage visual acuity as determined on the four charts. The results reported, whether they be improvement or diminution of vision after training, are therefore an increase or decrease in the percentage visual acuity, and not the percentage of gain or loss of vision.

From the statistical viewpoint, this method of reporting results leaves much to be desired. Primarily, as will be hereafter pointed out, it weights the scales in favor of improvement according to the degree of myopia. Secondly, grouping the patients according to the results involves the fallacy that each group contains individuals with all degrees of myopia. However, attempts to group the patients according to the degree of myopia

TABLE I.*
Patients Showing Improvement In All 4 Charts.

Cases	Average Percentage Visual Acuity				Average Percentage Improvement on 2nd Exam	
	Before Exercises		After Exercises			
	Right	Left	Right	Left	Right	Left
1	13	9	37	51	24	42
3	83	69	94	92	11	23
4	79	95	99	100	20	5
13	88	61	98	88	10	27
14	24	17	46	51	22	34
16	81	81	91	90	10	9
17	3	20	20	84	17	64
30	13	15	41	36	28	21
34	9	10	34	39	25	29
37	5	3	37	37	32	34
40	1	1	16	21	15	20
44	9	12	21	42	12	30
52	1	3	14	33	13	30
53	8	2	49	48	41	46
57	32	4	72	70	40	66
63	42	47	79	66	37	19
67	2	4	10	13	8	9
78	6	7	47	26	41	19
89	17	16	71	71	54	55
95	17	23	71	60	54	37
97	42	43	81	87	39	44
98	88	4	97	28	9	24
103	2	6	43	34	41	28
104	100	11	100	44	0	33
106	17	14	35	39	18	25
107	19	27	46	53	27	26
121	2	3	11	10	9	7
122	2	1	19	9	17	8
124	40	42	73	76	33	34
126	48	39	83	71	35	32
Average.......	29.76	22.97	54.5	52.3	24.7	29.3

resulted in a multiplicity of small tables which were meaningless. Further, since some patients had high degrees of anisometropia, the patient as an entity could not be grouped under one heading. The attempt to group the material under "eyes" rather than patients, completely ignored the individual subjective element. Although the patients in each of the four groups varied somewhat in the degree of their myopia, nevertheless, as will later be pointed out, the average percentage visual acuity of groups I and II was low, of group III was in the mid-zone, and of group IV was high. Therefore, despite the fact that grouping the patients on the basis of results rather than degree of myopia involves a statistical fallacy,

* The tables for this article were set up and provided for our use by the Transactions of the American Academy of Ophthalmology and Otolaryngology.

nevertheless the different groups roughly reflect different average levels of myopia, and this method appears to be the fairest and best calculated to give an accurate over-all picture.

RESULTS

On the basis of the average pre- and posttraining percentage visual acuity, the

acuity, or patients who showed an improvement in one eye and a loss of visual acuity in the second eye, irrespective of the degree.

IV. Patients who showed a loss of 10 points or more in the percentage visual acuity of one eye, while the second eye was either stationary or likewise showed some loss in percentage visual acuity.

TABLE II.
Results of Third Test Three Months After Completion of Exercises.
Patients Showing Improvement In All 4 Charts.

Cases	Improvement of Percentage Visual Acuity on 2nd Test		Final Improvement of Percentage Visual Acuity on Third Test	
	Right	Left	Right	Left
1	24	42	30	34
34	25	29	7	— 2
30	28	21	16	15
37	32	34	21	31
52	13	30	2	2
57	40	66	16	4
63	37	19	19	18
97	39	44	27	20
107	27	26	31	35
Average............	29.4	34.5	19.8	17.4

patients fall into four definite groups. These are:

I. Patients who showed a consistent improvement in each eye on all four charts.

II. Patients who did not show a consistent improvement on all four charts, yet in whom the over-all average in the percentage visual acuity after training was at least 10 points better in one eye than the pretraining figure, and in whom the second eye was at least no worse, irrespective of the fact than on one or more charts the posttraining vision was not improved, or might even be below the pretraining level.

III. Patients who showed no practical change in the eyes after training. This includes patients in whom the observed increase or decrease in vision was less than 10 points in the percentage visual

GROUP I

There were 30 of the 103 patients who showed a consistent improvement in each eye, on all four charts, of over 10 points in percentage visual acuity. The average results of these 30 patients are shown in table I.

Thus, the average improvement in percentage visual acuity in the right and left eyes was, respectively, about 24.7 and 29.3 points. This corresponds to an average improvement of reading about one to three additional lines on the Snellen charts, depending on the degree of myopia, a patient with high myopia, having a pre-exercise acuity of 20/200 and a postexercise acuity of 20/100, showing 28 points of improvement, whereas one with low myopia, having 20/50 pre-exercise acuity and 20/20 posttraining acuity, showed only 22 points of improvement,

TABLE III.
Patients Showing Inconsistent Improvement on Four Charts.

Cases	Average Percentage Visual Acuity				Average Improvement in Percentage Visual Acuity	
	Before Exercises		After Exercises			
	Right	Left	Right	Left	Right	Left
5	100	27	99	52	−1	25
9	16	18	27	47	11	29
12	27	16	42	27	15	12
20	68	70	82	84	14	14
27	16	24	21	41	5	17
28	88	22	90	59	2	27
29	2	4	4	26	2	22
32	27	15	32	27	5	12
35	17	11	20	31	7	20
38	2	1	19	16	17	16
39	4	5	10	15	6	10
41	21	31	68	32	47	1
42	21	14	21	28	+ −	14
46	7	18	18	18	11	+ −
48	4	4	10	22	6	18
49	4	2	6	26	4	24
50	16	16	34	21	18	5
51	8	3	8	17	+ −	14
60	49	17	62	50	13	37
65	18	19	27	32	9	13
66	21	23	39	46	18	23
68	14	17	33	30	19	13
70	35	35	52	55	17	20
74	22	26	31	47	9	21
79	42	56	77	57	25	1
88	8	17	15	35	7	18
94	12	28	54	56	42	28
96	57	44	67	72	10	28
109	3	98	21	98	18	+ −
110	15	11	27	17	12	6
127	24	34	55	49	31	15
Average......	24.8	23.4	37.8	39.8	13.0	16.4

despite the more spectacular improvement on the Snellen scale.

A consistent effort was made to have each of these 30 patients return for a third examination to determine to what extent the improvement observed on the second examination had been maintained. These efforts were successful in only nine instances. The remaining 21 patients had either disappeared or had lost interest and did not respond to the request to return. A comparison of the gain over the pretraining level showed by these nine patients is set forth in table II.

In these nine patients the average gain in percentage visual acuity disclosed on the second examination in the right and left eyes was, respectively 29.4 and 34.5

points. On the third examination, performed from three to five months after the second examination, this had dropped to 19.8 points in the right eye and 17.4 points in the left eye. In two patients (1 and 107) the improvement noted on the second examination had, on the average, been maintained. In the remaining seven, the observed improvement had declined.

GROUP II

There were 31 patients who, while they showed no consistent improvement on all patient (60) had lost two thirds of the observed improvement. One patient (127) had lost two thirds of the improvement noted in the right eye, and all the improvement in the left eye. The remaining three patients (41, 79, and 110) had lost all of the improvement observed in both eyes, the final figures being actually below the pretraining level although the diminution was in no case significant. The final average gain of these eight patients was six points in the right eye and 1.9 points in the left eye. In short, the average percentage visual acuity was essentially unchanged.

TABLE IV.
Results of Third Test Three Months After Completion of Exercises In Patients Showing Inconsistent Improvement On Four Charts.

Cases	Improvement of Percentage Visual Acuity In 2nd Test		Final Improvement of Percentage Visual Acuity On Third Test	
	Right	Left	Right	Left
9	11	29	19	10
20	14	14	16	11
41	47	1	− 5	− 7
60	13	33	4	10
70	17	20	22	20
79	35	1	−16	−22
110	12	6	− 2	− 5
127	31	15	+10	− 2
Average............	22.5	14.9	+ 6	+ 1.9

four charts, nevertheless showed an overall average improvement of at least 10 points in one eye, and no loss in the second eye. The average records of these patients are set forth in table III.

The average improvement of percentage visual acuity of these 31 patients was 13.0 points in the right eye and 16.4 points in the left eye. Eight of these patients returned for a third examination, three to five months after the completion of the training. A comparison of the gain disclosed in the second examination against the final change shown in the third examination is shown in table IV.

Three patients (9, 20, and 70) had roughly maintained the improvement observed on the second examination. One

GROUP III

There were 32 patients in this group who showed only minor change in the visual acuity after visual training. The changes noted were: (a) either less than 10 points in the percentage visual acuity either on the plus or minus side in each eye, or (b) a variation of greater than 10 points plus in one eye while the second eye showed a loss in percentage visual acuity. The average swing in these 32 patients was +4.1 points in the right eye and +2.4 points in the left eye. No attempt was made to bring these patients back for a third examination. The average figures for these 32 patients are shown in table V.

TABLE V.
Patients Showing No Significant Change In Percentage Visual Acuity After Exercises.

Cases	Average Percentage Visual Acuity				Average Change In Visual Acuity	
	Before Exercises		After Exercises			
	Right	Left	Right	Left	Right	Left
2	95	98	98	99	+3	+1
6	77	79	77	79	+—	+—
7	78	82	73	84	—5	+2
8	46	61	51	69	+5	+8
10	18	42	22	43	+4	+1
15	30	20	25	30	—5	+10
23	14	61	21	53	+7	—8
33	51	68	42	80	—9	+12
36	38	32	37	43	—1	+11
54	62	69	62	74	+—	+5
55	86	81	85	76	—1	—5
58	50	87	66	83	+16	—4
59	9	13	14	20	+5	+7
64	3	2	4	9	+1	+7
69	22	24	29	24	+7	+—
71	9	6	18	11	+9	+5
72	27	21	22	23	—5	+2
75	2	1	11	4	+9	+3
81	62	54	69	51	+7	—3
85	23	39	22	39	—1	+—
86	1	2	3	4	+2	+2
87	2	3	5	12	+3	+9
90	9	23	6	41	—3	+18
91	10	16	36	11	+26	—5
93	16	10	16	13	+—	+3
99	79	80	88	87	+9	+7
100	86	89	85	89	—1	+—
101	20	12	24	15	+4	+3
105	34	71	67	52	+33	—19
111	100	25	100	26	+—	+1
112	21	56	28	52	+7	—4
131	20	23	26	32	+6	+9
Average.......	37.5	42.2	41.6	44.6	+4.1	+2.4

GROUP IV

There were 10 patients who showed a diminution in the percentage visual acuity in both eyes after visual training. As already stated, these changes on the minus side were insignificant, and well within the subjective margin of error. The changes averaged —12.7 points in percentage visual acuity in the right eye, and —8.9 points in the left eye. The average figures for these 10 patients are given in table VI.

A summary of these four groups is shown in table VII.

A number of these 103 patients, 67 in all, were again retinoscoped under a

TABLE VI.
Patients Showing Slightly Diminished Percentage Visual Acuity After Exercises.

Cases	Average Percentage Visual Acuity				Average Loss In Visual Acuity	
	Before Exercises		After Exercises			
	Right	Left	Right	Left	Right	Left
18	92	17	85	7	—7	—10
22	97	90	96	76	—1	—14
31	65	81	60	69	—5	—12
45	79	68	69	68	—10	+—
56	..	26	..	14	..	—12
76	85	77	76	77	—9	+—
77	83	78	66	74	—17	—4
83	70	44	20	40	—50	—4
84	88	96	79	79	—9	—17
108	95	91	89	75	—6	—16
Average.......	83.7	66.8	71.0	57.9	—12.7	—8.9

cycloplegic on the second examination after completion of the eye exercises. A comparison of the pre- and postexercise retinoscopies is shown in table VIII. It is immediately apparent that the visual training had produced no change in the basic myopic error. The occasional minor changes noted are those which would result in variations of the action of the cycloplegic.

COMMENT

It is not within the scope of this report to discuss any theoretical merits or demerits in the visual-training program detailed in the optometric literature and used on these patients, or to comment upon other popular theories which have at one time or another been advanced in support of the treatment of myopia by eye exercises or visual training. While

we did determine the retinoscopic error in a number of the patients before and after the visual training to ascertain if any change had occurred in the basic refraction, and we likewise followed with interest changes in the psychologic reaction of the trainees toward their visual handicap, nevertheless our chief objective in this experiment was to determine if the visual training produced any significant alteration in the visual acuity of the trainees. The complete data from which conclusions on the latter point are drawn are given in table IX. Comment here is limited to statistical criticism of these data, and to observations on the reaction of the patients to the visual training.

Primarily, this study is *per se* uncontrolled. A proper control would be a

TABLE VII.
Summary of Results.

Status of Patient	No. and Percentage of Total Group	Average Net Change In Percentage Visual Acuity	
		Right	Left
Improvements on all four Charts..........	30 or 29.1%	24.7	29.3
Inconsistent Improvement.................	31 or 30.1%	13.0	16.4
No Essential Change.....................	32 or 31.1%	+4.1	+2.4
Slightly Diminished Visual Acuity..........	10 or 9.7%	—12.7	—8.9

TABLE VIII.
Retinoscopic Findings Before and After "Visual Training."

	Before Visual Training	After Visual Training
Case 2...............	R. — 0.75 = + 0.25 ×90 L. — 0.25 = — 0.37 ×180	R. — 0.75 L. — 0.50 = + 0.25 ×50
Case 10...............	R. — 2.50 L. — 2.25	R. — 2.25 L. — 2.00
Case 12...............	R. — 2.50 = — 0.50 ×90 L. — 2.50	R. — 3.50 L. — 3.00 = — 0.50 ×180
Case 14...............	R. — 1.75 L. — 1.62	R. — 2.00 L. — 1.75
Case 15...............	R. — 2.75 L. — 3.75 = — 0.50 ×120	R. — 3.37 L. — 4.00 = — 0.62 ×180
Case 16...............	R. — 1.00 L. — 1.00	R. — 1.50 L. — 1.00
Case 17...............	R. — 4.25 L. — 3.00	R. — 4.00 L. — 2.50 = — 0.50 ×180
Case 18...............	R. — 0.75 = — 0.37 ×90 L. — 5.50	R. — 0.75 = — 0.50 ×90 L. — 5.50
Case 20...............	R. — 0.75 L. — 1.00	R. — 0.25 = — 0.50 ×20 L. — 0.25 = — 0.25 ×140
Case 22...............	R. — 0.25 ×180 L. — 0.75 = + 0.25 ×90	R. + 0.25 ×90 L. — 0.75
Case 23...............	R. — 2.00 = — 0.50 ×10 L. — 1.50	R. — 2.25 = — 0.25 ×180 L. — 1.50
Case 28...............	R. — 0.62 = — 0.25 ×180 L. — 2.00 = — 0.75 ×180	R. — 0.75 L. — 2.25 = — 0.50 ×180
Case 29...............	R. — 2.75 = — 1.75 ×180 L. — 2.50 = — 0.75 ×180	R. — 2.75 = — 1.50 ×180 L. — 2.50 = — 0.75 ×180
Case 30...............	R. — 3.00 = — 0.50 ×170 L. — 3.00 = — 0.25 ×20	R. — 4.50 L. — 4.50
Case 32...............	R. — 3.00 = — 0.50 ×90 L. — 3.25 = — 0.25 ×80	R — 3.00 = — 0.50 ×90 L. — 3.00 = — 0.37 ×90
Case 33...............	R. — 0.75 = — 0.50 ×180 L. — 0.75 = — 0.50 ×175	R. — 1.25 = — 0.50 ×180 L. — 0.50 = — 0.25 ×180
Case 34...............	R. — 2.25 = — 0.75 ×165 L. — 3.50 = — 1.00 ×175	R. — 3.00 = — 0.50 ×180 L. — 4.00 = — 0.50 ×180
Case 35...............	R. — 3.25 = — 0.25 ×165 L. — 2.75 = — 0.50 ×160	R. — 3.50 = — 1.00 ×175 L. — 3.75
Case 37...............	R. — 2.0 = — 0.75 ×130 L. — 2.0 = — 0.50 ×180	R. — 3.00 L. — 3.25
Case 38...............	R. — 3.25 L. — 3.25 = — 0.50 ×35	R. — 2.50 = — 0.50 ×180 L. — 3.25 = — 0.50 ×35
Case 40...............	R. — 7.0 = — 1.0 ×180 L. — 7.0 = — 0.50 ×180	R. — 6.75 = — 1.0 ×180 L. — 6.50 = — 0.50 ×180
Case 42...............	R. — 2.75 L. — 2.75 = — 0.25 ×170	R. — 2.75 L. — 2.75
Case 43...............	R. — 2.75 L. — 2.75 = — 0.25 ×180	R. — 2.75 L. — 2.75
Case 45...............	R. — 0.50 L. — 0.75	R. — 0.50 L. — 0.75
Case 46...............	R. — 4.00 = — 0.50 ×165 L. — 4.0 = — 0.50 ×180	R. — 4.0 = — 0.50 ×180 L. — 4.0 = — 0.37 ×20
Case 50...............	R. — 2.50 = — 0.75 ×5 L. — 2.25 = — 0.50 ×180	R. — 2.50 L. — 2.50
Case 51...............	R. — 3.75 = — 0.50 ×180 L. — 3.75 = — 0.75 ×180	R. — 3.87 = — 0.50 ×180 L. — 3.87 = — 0.75 ×180
Case 52...............	R. — 5.0 = — 2.25 ×15 L. — 4.0 = — 2.50 ×165	R. — 5.50 = — 1.50 ×15 L. — 4.25 = — 3.25 ×165
Case 53...............	R. — 4.0 L. — 4.0	R. — 4.0 = — 0.50 ×180 L. — 4.50

TABLE VIII.—Continued
Retinoscopic Findings Before and After "Visual Training."

	Before Visual Training	After Visual Training
Case 54............	R. — 1.50 L. — 1.25	R. — 1.37 L. — 1.25
Case 55............	R. — 4.0 = — 0.25 ×90 L. — 3.75 = — 0.50 ×90	R. — 4.25 = — 0.50 ×90 L. — 4.0 = — 0.50 ×90
Case 56............	R. — 1.25 = + 2.25 ×90 L. — 2.0 = — 3.50 ×165	R. — 1.25 = + 2.0 ×90 L. — 2.0 = + 3.50 ×165
Case 57............	R. — 2.0 L. — 4.0 = — 0.50 ×180	R. — 2.25 L. — 4.0 = — 0.50 ×180
Case 59............	R. — 3.0 L. — 3.0 = — 0.25 ×180	R. — 3.25 L. — 3.25
Case 69............	R. — 1.50 = — 1.25 ×15 L. — 1.50 = — 1.0 ×165	R. — 2.0 = — 0.75 ×180 L. — 2.25 = — 0.75 ×180
Case 71............	R. — 6.50 = — 0.50 ×90 L. — 6.50 = — 0.50 ×90	R. — 7.0 = — 0.50 ×90 L. — 6.50 = — 0.50 ×90
Case 75............	R. — 4.0 = — 3.0 ×180 L. — 6.0 = — 2.50 ×160	R. — 4.0 = — 3.0 ×180 L. — 5.50 = — 2.50 ×180
Case 76............	R. — 0.50 = — 0.25 ×135 L. — 0.75	R. — 0.50 = — 0.25 ×135 L. — 0.75
Case 77............	R. — 0.50 ×90 L. — 0.50	R. — 0.75 = + 0.25 ×90 L. — 0.75
Case 78............	R. — 6.25 L. — 5.50 = — 0.75 ×180	R. — 6.50 L. — 6.25 = — 0.50 ×180
Case 79............	R. — 1.75 = — 0.25 ×180 L. — 1.50 = — 0.25 ×180	R. — 1.75 L. — 2.0
Case 81............	R. — 2.0 L. — 2.0	R. — 2.25 L. — 2.0
Case 84............	R. — 0.75 L. — 0.50	R. — 1.75 L. — 2.0
Case 85............	R. — 3.25 L. — 2.0	R. — 3.0 L. — 1.50 = — 0.75 ×180
Case 87............	R. — 3.50 = — 0.25 ×90 L. — 3.75	R. — 3.25 L. — 3.25 = — 0.25 ×90
Case 89............	R. — 2.50 L. — 2.75 = — 0.25 ×180	R. — 1.75 = — 0.25 ×180 L. — 1.75 = — 0.25 ×180
Case 90............	R. — 4.25 L. — 2.0 = — 0.50 ×90	R. — 4.50 L. — 2.50 = — 0.50 ×180
Case 91............	R. — 4.25 L. — 4.50	R. — 3.50 = — 0.25 ×180 L. — 4.25
Case 94............	R. — 2.50 = — 0.50 ×180 L. — 2.25	R. — 2.50 = — 0.50 ×180 L. — 2.25
Case 95............	R. — 1.50 = — 0.50 ×90 L. — 2.0 = — 0.25 ×90	R. — 1.75 = — 0.25 ×90 L. — 2.0 = — 0.25 ×30
Case 96............	R. — 1.25 = — 0.50 ×20 L. — 1.50 = — 0.50 ×135	R. — 1.25 L. — 1.25
Case 97............	R. — 1.00 = — 0.25 ×90 L. — 1.00 = — 0.25 ×90	R. — 0.75 L. — 1.0
Case 99............	R. — 0.50 = — 0.50 ×175 L. — 0.75 = — 0.25 ×180	R. — 1.25 = + 0.50 ×75 L. — 1.25 = + 0.50 ×90
Case 100............	R. — 0.37 L. — 0.37 = — 0.25 ×25	R. — 0.75 L. — 0.75 = — 0.25 ×180
Case 101............	R. — 2.25 = — 0.50 ×95 L. — 2.75 = — 0.50 ×85	R. — 2.50 = — 0.25 ×90 L. — 2.75 = — 0.25 ×85
Case 103............	R. — 4.0 = — 0.75 ×180 L. — 4.50 = — 0.50 ×175	R. — 3.75 = — 0.75 ×180 L. — 5.0 = — 0.50 ×175
Case 105............	R. — 1.25 = — 0.75 ×180 L. — 0.75 = — 0.75 ×180	R. — 1.25 = — 1.0 ×180 L. — 0.75 = — 0.50 ×180
Case 106............	R. — 2.75 L. — 2.0 = — 0.25 ×180	R. — 2.75 L. — 2.50

TABLE VIII.—Continued
Retinoscopic Findings Before and After "Visual Training."

	Before Visual Training	After Visual Training
Case 107...............	R. — 1.75 = — 0.50 ×180 L. — 2.0 = — 0.25 ×180	R. — 1.50 = — 0.50 ×180 L. — 1.75 = — 0.50 ×180
Case 108...............	R. — 0.37 L. — 0.62	R. — 0.75 L. — 1.50
Case 112...............	R. — 2.50 L. — 2.50	R. — 2.50 L. — 2.50
Case 121...............	R. — 3.25 = — 0.25 ×90 L. — 4.0 = — 0.75 ×180	R. — 3.75 L. — 4.0 = — 0.75 ×160
Case 122...............	R. — 4.0 L. — 4.0	R. — 4.0 L. — 4.0 = — 0.50 ×90
Case 124......	R. — 1.50 L. — 1.25 = — 0.25 ×180	R. — 1.25 = — 0.50 ×20 L. — 0.75
Case 126...	R. — 1.25 = — 0.50 ×180 L. — 1.25 = — 0.50 ×180	R. — 1.50 = — 0.75 ×180 L. — 1.50 = — 0.50 ×180
Case 127.	R. — 3.25 = — 0.25 ×90 L. — 2.25 = — 0.25 ×180	R. — 2.75 L. — 2.75
Case 131...............	R. — 2.0 L. — 1 75 = — 0.25 ×180	R. — 2.0 L. — 1.75

group of myopic individuals of similar age and degree of myopia whose visual acuity without correction was determined at the times of the first and second examination and who were not subjected to visual training and did not wear glasses. However, the absence of a control group is unimportant. Every ophthalmologist will concede that within a three-months' period without any treatment, a group of 103 myopic individuals would show no significant improvement in their uncorrected vision. The one pertinent question is, therefore: Are the changes in the percentage visual acuity noted in these patients of any significance? These figures disclose several points pertinent to this question.

First. The uncorrected visual acuity varied within wide limits in individuals with approximately the same degree of myopia. For example, patients 1 and 14 with approximately the same degree of myopia (−1.75D. sph. and −1.75D. sph. ☞ −.25D. cyl. ax. 80°) had 16/200 and 20/200 vision, whereas 63 and 79, with myopic errors of −1.75D. sph. ☞ −.25D. cyl. ax. 180°, showed visual acuity of 20/100 + 1 and 20/100. The average percentage visual acuity of these four

patients with practically identical refractive errors was, respectively, 13, 24, 42, and 42, a swing of 29 points. Similar variations (table IX) occurred in all grades of myopia. The visual acuity of any myopic person is obviously influenced by a large subjective element—the individual interpretation of a blurred retinal image.

Second. There was often an amazing swing in the percentage visual acuity of the same individual on the same day when vision was tested on different charts. This, for example, was exhibited in case 5, wherein percentage visual acuity, varied from 20 to 41; case 8, from 20 to 58; case 17, from 1 to 49; and case 57, from 8 to 73! Swings of from 20 to 30 points in the different charts were the rule rather than the exception in patients with an average percentage visual acuity in the mid-range. This swing was irregular, some patients doing better on one chart than on another.

Third. The method of computing the results on the basis of a change in the percentage visual acuity weights the scales in favor of an improvement according to the severity of the myopia. Thus an individual with high myopia who has an initial 10/200 vision has a percentage

CHART IX.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 1		−1.75 = 20/20 +4		−1.75 = −0.50 ×180 = 20/20		
Letters	RE............	16/200	13	20/200	20	+7
	LE............	15/200	11	20/100	49	+38
Landolt	RE	12/200	7	20/175	26	+19
	LE	10/200	3	20/125	40	+37
E	RE	20/200	20	20/80 +2	59	+39
	LE	18/200	17	20/80	58	+41
Numbers	RE	15/200	11	20/100 +1	49	+38
	LE............	12/200	7	20/70 −1	60	+53
CASE 1		**Third Test**				
Letters	RE............	20/100	49	......	..	....
	LE............	20/100 −1	37	......	..	....
Landolt	RE	20/150	31	......	..	....
	LE	20/150	31	......	..	....
E	RE	20/80 −2	56	......	..	....
	LE	20/80 −2	56	......	..	....
Numbers	RE	20/200 +1	37	......	..	....
	LE............	20/100	49	......	..	....
CASE 2		−0.75 = +0.25 ×90 = 20/15 −4		−0.25 = −0.37 ×180 = 20/20 +4		
Letters	RE	20/20 +1	100+	20/20 −1	99 −	−1
	LE	20/20 +4	100+	20/15 −2	100+	+−
Landolt	RE	20/40	84	20/30	92	+8
	LE	20/30	92	20/25	96	+4
E	RE	20/25	96	20/20 +3	100+	+4
	LE	20/20	100	20/15	100+	+
Numbers	RE	20/20 −1	100 −	20/20 +2	100+	+
	LE............	20/20 −1	100 −	20/15 −3	100+	+
CASE 3		−0.37 = 20/15		−1.12 + 20/15		
Letters	RE	20/40 −1	82	20/20 −2	100 −	+18
	LE	20/60	70	20/20 −4	100 −	+30
Landolt	RE	20/60 −1	69	20/45 −2	79	+10
	LE	20/85	56	20/45 +1	81	+25
E	RE	20/30	92	20/20 −4	100 −	+8
	LE	20/50	76	20/25	96	+20
Numbers	RE	20/30 −2	90	20/20 −4	100 −	+10
	LE............	20/50	76	20/30 −1	91	+15
CASE 4		−0.50 = −0.25 = ×90 = 20/15		−0.25 = −0.50 ×60 = 20/15		
Letters	RE	20/40 +1	83	20/15	100+	+17
	LE	20/20 −1	99	20/15 −2	100+	+1
Landolt	RE	20/60 +1	70	20/25	96	+26
	LE	20/40	83	20/17.5	100+	+17
E	RE	20/40	83	20/15 −2	100+	+17
	LE	20/20 −1	100 −	20/15	100+	+−
Numbers	RE	20/40 +1	83+	20/20 +2	100+	+17
	LE............	20/20 −1	100 −	20/15	100+	+−
CASE 5		−0.25 ×90 = 20/15		−1.25 = 20/15		
Letters	RE............	20/15 −2	100+	20/15 −1	100+	+−
	LE............	20/200	20	20/70	64	+44
Landolt	RE	20/20 −4	100 −	20/25 −1	95	−5
	LE	20/125	37	20/175	26	−11
E	RE	20/15	100+	20/15	100+	+−
	LE	20/120	41	20/80 −2	58	+17
Numbers	RE	15 −3	100+	20/20 −1	100 −	+−
	LE........	00	20	17/70 −1	58	+38
CASE 6		= 20/15		−0.75 = 20/15		
Letters	RE.....		83	20/30	92	+9
	LE....	40 +2	84	20/40	83	−1
Landolt	RE...	60 −1	70	20/85	56	−14
	LE...	20/60 +1	70	20/70 −1	64	−6
E	RE...	20/50	76	20/40	83	+7
	LE........	20/40 −2	81	20/40 +3	89	+8
Numbers	RE........	20/50 +1	77	20/40 −1	83	+6
	LE............	20/40	83	20/40 −1	82	−1
CASE 7		−0.75 = 20/15 −1		−0.50 = −0.25 = 20/15		
Letters	RE............	20/30 −2	91	20/30 −2	91	+−
	LE............	20/25 −2	95	20/30	92	−3
Landolt	RE	20/70 −1	63	20/100	49	−14
	LE	20/70 −1	63	20/60 −1	69	+6
E	RE	20/30 −2	91	20/50 −2	75	−16
	LE	20/40	84	20/30 −1	91	+7
Numbers	RE............	20/70 +2	65	20/50 +2	77	+12
	LE............	20/40	84	20/40 −3	82	−2

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 8		$-1.50 = -0.25 \times 180 = 20/20 -4$		$-1.37 = -0.25 \times 40 = 20/15$		
Letters	RE...........	20/100	49	20/60 -2	68	+19
	LE...........	20/60 $+1$	71	20/50	76	+5
Landolt	RE...........	20/85 $+1$	55	20/125	37	−18
	LE...........	20/125	37	20/100	49	+12
E	RE...........	20/80	58	20/80	58	+ −
	LE...........	20/80	58	20/50 -2	74	+16
Numbers	RE...........	20/200	20	20/70	64	+44
	LE...........	20/50 -1	76	20/50	76	+ −
CASE 9		$-2.50 = 20/20$		$-2.75 = -0.50 \times 10 = 20/20$		
Letters	RE...........	20/200	20	20/200	20	+ −
	LE...........	20/200	20	15/50	66	+46
Landolt	RE...........	20/200	20	20/200	20	+ −
	LE...........	20/200	20	15/200	15	−5
E	RE...........	20/200	20	20/80 -1	58	+38
	LE...........	20/200	20	15/70	54	+34
Numbers	RE...........	10/200	3	20/200	20	+17
	LE...........	20/200 -1	12	15/70	54	+42
CASE 9		**Third Test**				
Letters	RE...........	20/100	49	......	..	....
	LE...........	20/100 -1	37	......	..	....
Landolt	RE...........	20/150	31	......	..	....
	LE...........	20/150	31	......	..	....
E	RE...........	20/160	29	......	..	....
	LE...........	20/120	41	......	..	....
Numbers	RE...........	20/200	20	......	..	....
	LE...........	20/200	20	......	..	....
CASE 10		$-2.50 = 20/15$		$-2.25 = 20/15$		
Letters	RE...........	20/200	20	20/200	20	+ −
	LE...........	20/100 $+1$	53	20/100 -1	37	−16
Landolt	RE...........	10/200	3	15/200	15	+12
	LE...........	20/200	20	20/150	31	+11
E	RE...........	20/160 -1	28	20/120 -1	40	+12
	LE...........	20/80	58	20/80 -2	56	−2
Numbers	RE...........	20/200	20	20/200 -1	12	−8
	LE...........	20/200 $+1$	37	20/100	49	+12
CASE 12		$-2.50 = -0.50 \times 90 = 20/20$		$-2.50 = 20/20$		
Letters	RE...........	20/100 -1	37	20/100	49	+12
	LE...........	20/300	8	20/100	49	+41
Landolt	RE...........	15/200	11	20/200	20	+9
	LE...........	16/200	13	20/200	3	−10
E	RE...........	20/100	49	20/200 $+1$	37	−12
	LE...........	20/200	20	20/200	20	+ −
Numbers	RE...........	15/200	11	20/200	20	+9
	LE...........	17/200	14	20/200 $+1$	37	+23
CASE 13		$-0.75 = +0.50 = 20/15$		$-0.75 = +0.25 \times 60 = 20/20$		
Letters	RE...........	20/25 -2	94	20/15 -2	100	+6
	LE...........	20/60 -1	68	20/30	92	+24
Landolt	RE...........	20/60	70	20/25 -2	94	+24
	LE...........	20/85 -1	55	20/50 $+1$	78	+23
E	RE...........	20/20 -2	98	20/15 -1	100 $+$	+2
	LE...........	20/80	58	20/25 -2	94	+36
Numbers	RE...........	20/30	92	20/15 -2	100 $+$	+8
	LE...........	20/70 -1	63	20/30 -1	91	+28
CASE 14		$-1.75 = 20/20$		$-1.62 = 20/20$		
Letters	RE...........	20/200 $+1$	37	20/70 -1	59	+22
	LE...........	20/200	20	20/70 -1	59	+39
Landolt	RE...........	13/200	9	20/200	20	+11
	LE...........	18/200	7	20/125	39	+32
E	RE...........	20/120 -1	30	10/40 $+2$	55	+25
	LE...........	20/160 $+1$	24	20/120 $+1$	45	+21
Numbers	RE...........	20/200	20	15/70	52	+32
	LE...........	20/200	20	20/70	64	+44
CASE 15		$-2.75 = 20/20 -1$		$-3.75 = -0.50 \times 120 = 20/20 -2$		
Letters	RE...........	20/200	20	20/100	49	+29
	LE...........	20/200	20	20/100 -1	37	+17
Landolt	RE...........	20/200	20	10/200	3	−17
	LE...........	20/200	20	10/200	3	−17
E	RE...........	20/200	20	20/200	20	+ −
	LE...........	20/200	20	20/200	20	+ −
Numbers	RE...........	20/70 -1	60	20/100	49	−11
	LE...........	20/200	20	20/100 $+2$	59	+39

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 16		−1.50 = 20/20		−1.00 = 20/20		
Letters	RE	20/60	70	20/30 −3	88	+18
	LE	20/50	77	20/30 −2	90	+13
Landolt	RE	20/50	77	20/35 −1	86	+9
	LE	20/50	77	20/35	87	+10
E	RE	20/40	84	20/25 +4	97	+13
	LE	20/40	84	20/25 −4	94	+10
Numbers	RE	20/30	93	20/30 +1	94	+1
	LE	20/30 −3	88	20/30	92	+4
CASE 17		−4.25 = 20/20 −1		−3.00 = 20/20		
Letters	RE	20/300	8	20/200	20	+12
	LE	20/100	49	20/30 −3	88	+39
Landolt	RE	6/200	1	15/200	11	+10
	LE	10/200	3	20/45	80	+77
E	RE	10/200	3	20/160	29	+26
	LE	20/160	29	20/40	84	+55
Numbers	RE	6/200	1	20/200	20	+19
	LE	8/200	1	20/40 +2	87	+86
CASE 18		−0.75 = −0.37 ×90 = 20/15		−5.50 = 20/15		
Letters	RE	20/20	100	20/30 −2	90	−10
	LE	20/300	8	10/200	3	−5
Landolt	RE	20/50	76	20/60 −1	68	−8
	LE	20/200	20	10/200	3	−17
E	RE	20/30	92	20/30 −1	91	−1
	LE	20/160	38	15/200	11	−27
Numbers	RE	20/30 −2	90	20/30 −2	90	+ −
	LE	10/200	3	10/200 +1	9	+6
CASE 20		−0.75 = 20/20		−1.00 = 20/20		
Letters	RE	20/70	64	20/50 +2	80	+16
	LE	20/70	64	20/20 −3	97	+33
Landolt	RE	20/70	64	20/50 −1	75	+11
	LE	20/70	64	20/70 −1	60	−4
E	RE	20/60	70	20/30 +3	96	+26
	LE	20/50	76	20/30 −3	88	+12
Numbers	RE	20/50 −2	73	20/50	76	+3
	LE	20/50	76	20/30 −1	91	+15
CASE 20		Third Test				
Letters	RE	20/40	83	....	..	....
	LE	20/40	83	....	..	....
Landolt	RE	20/45	80	....	..	....
	LE	20/60	70	....	..	....
E	RE	20/30 +3	96	....	..	....
	LE	20/30 −2	91	....	..	....
Numbers	RE	20/40 −2	81	....	..	....
	LE	20/40 −2	81	....	..	....
CASE 22 LE		−0.75 = +0.25 ×90 = 20/15				
Letters	RE	20/15	100+	20/15 −2	..	....
	LE	20/30 −1	91	20/40	84	−7
Landolt	RE	20/35	88	20/40	84	−4
	LE	20/50 +2	80	20/100	49	−31
E	RE	20/15 −2	100+	20/20	100	+ −
	LE	20/30	92	20/40 −1	82	−10
Numbers	RE	20/20 −1	99	20/15 −3	100	+1
	LE	20/20 −4	96	20/40 +3	89	−7
CASE 23		−2.00 = −0.50 ×10 = 20/20		−1.50 = 20/20		
Letters	RE	20/200	20	15/200	11	−9
	LE	20/80	59	20/70 −1	60	+1
Landolt	RE	10/200	3	10/70	34	+31
	LE	20/100	54	20/175	25	−29
E	RE	20/200	20	10/80	29	+9
	LE	20/60	70	20/80 +2	62	−8
Numbers	RE	20/200 −1	14	15/200	11	−3
	LE	20/70 −1	59	20/70 +1	66	+7
CASE 26		−1.25 = −0.25 ×90 = 20/20		−1.25 = −0.25 ×80 = 20/20		
Letters	RE	20/100	49	20/200	20	−29
	LE	20/70 −1	60	20/70 +1	66	+6
Landolt	RE	20/200	20	10/125	13	−7
	LE	20/100	49	20/175 −1	23	−26
E	RE	15/200	11	15/80	49	+38
	LE	20/60	70	15/160	17	−53
Numbers	RE	15/200	11	20/200 +1	37	+26
	LE	20/70 +1	66	20/100 −1	37	−29

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 27		$-2.50 = -0.50 \times 85 = 20/20$		$-2.62 = 20/20$		
Letters	RE............	20/200	20	10/100	20	+ −
	LE............	20/200	20	20/100 −1	37	+17
Landolt	RE............	12/200	8	10/125	13	+5
	LE............	18/200	17	20/200	20	+3
E	RE............	20/200	20	10/80	38	+18
	LE............	20/160	39	20/80	59	+20
Numbers	RE............	12/200	8	10/70	34	+26
	LE............	20/200	20	20/100	49	+29
CASE 28		$-0.62 = -0.25 \times 180 = 20/20$		$-2.00 = -0.75 \times 180 = 20/20$		
Letters	RE............	20/30	92	20/20 −4	96	+4
	LE............	20/400	3	10/30 −1	68	+65
Landolt	RE............	20/35	87	20/45	80	−7
	LE............	15/200	11	10/70	34	+23
E	RE............	20/40	84	20/25	96	+12
	LE............	20/160 +1	24	10/25	76	+52
Numbers	RE............	20/30 −2	90	20/30 −3	88	−2
	LE............	20/100	49	10/40 −2	56	+7
CASE 29		$-2.75 = -1.75 \times 180 = 20/25$		$-2.50 = -0.75 \times 180 = 20/20$		
Letters	RE............	20/400	3	15/200	3	+ −
	LE............	20/400	3	10/70 −1	28	+25
Landolt	RE............	6/200	1	10/175 −1	4	+3
	LE............	10/200	3	10/100	20	+17
E	RE............	10/200	3	10/160	7	+4
	LE............	7/160	7	10/80	28	+21
Numbers	RE............	8/200	2	10/200 +1	4	+2
	LE............	10/200	3	10/70 −1	28	+25
CASE 30		$-3.00 = -0.50 \times 170 = 20/20$		$-3.00 = -0.25 \times 20 = 20/20$		
Letters	RE............	20/200	20	20/70	64	+44
	LE............	20/200	20	20/70 −1	60	+40
Landolt	RE............	10/200	3	20/125	37	+34
	LE............	15/200	11	20/175	25	+14
E	RE............	20/200	20	20/120	41	+21
	LE............	15/200	11	20/120	41	+30
Numbers	RE............	12/200	8	20/200	20	+12
	LE............	18/200	17	20/200	20	+3
CASE 30		**Third Test**				
Letters	RE............	20/100 −1	37	......	..	....
	LE............	20/100	49	......	..	....
Landolt	RE............	17/200	14	......	..	....
	LE............	17/200	14	......	..	....
E	RE............	20/160	29	......	..	....
	LE............	18/200	7	......	..	....
Numbers	RE............	20/200 +1	37	......	..	....
	LE............	20/100	49	......	..	....
CASE 31		$-0.62 = -0.50 \times 90 = 20/20$		$-0.75 = -0.50 \times 100 = 20/20$		
Letters	RE............	20/60 −1	68	20/50 +2	80	+12
	LE............	20/30 −2	90	20/50 −1	75	−15
Landolt	RE............	20/100	49	20/175	25	−24
	LE............	20/40	84	20/85	56	−28
E	RE............	20/40	84	20/80 +2	62	−22
	LE............	20/30 −3	88	20/60 +2	72	−16
Numbers	RE............	20/70 −1	60	20/50 −1	75	+15
	LE............	20/40 −1	82	20/50 −3	71	−11
CASE 32		$-3.00 = -0.62 \times 95 = 20/20$		$-3.25 = -0.25 \times 80 = 20/20 -2$		
Letters	RE............	20/200	20	15/100 −1	27	+7
	LE............	20/200	20	10/70	34	+14
Landolt	RE............	20/200	20	15/200	11	−9
	LE............	10/200	3	10/125 −1	11	+8
E	RE............	20/160	29	15/80	49	+20
	LE............	18/200	17	10/80	29	+12
Numbers	RE............	20/200	20	15/100 +1	43	+23
	LE............	20/200	20	10/70	34	+14
CASE 33		$-0.75 = -0.50 \times 180 = 20/20$		$-0.75 = -0.50 \times 175 = 20/20$		
Letters	RE............	20/100	49	20/200 +1	37	−12
	LE............	20/50 −1	75	20/40 +2	87	+12
Landolt	RE............	20/150	31	20/150	31	+ −
	LE............	20/100 −1	37	20/60 −1	68	+31
E	RE............	20/80	59	20/120	41	−18
	LE............	20/40 −1	83	20/40	84	+1
Numbers	RE............	20/70	64	20/100	49	−15
	LE............	20/50 −1	75	20/40 −1	82	+7

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 34		$-2.25 = -0.75 \times 65 = 20/20$		$-3.50 = -1.00 \times 175 = 20/15 -4$		
Letters	RE	12/200	8	20/100 +1	54	+46
	LE	16/200	13	20/70 −1	60	+47
Landolt	RE	10/200	3	20/175 −1	23	+20
	LE	6/250	1	20/200	20	+19
E	RE	20/200	20	20/120	41	+21
	LE	20/200	20	20/160 −1	28	+8
Numbers	RE	12/200	8	20/200	20	+12
	LE	12/200	8	20/100	49	+41
CASE 34		**Third Test**				
Letters	RE	15/200	11	......	..	....
	LE	10/200	3	......	..	....
Landolt	RE	15/175	16	......	..	....
	LE	15/200	11	......	..	....
E	RE	20/200	20	......	..	....
	LE	15/200	11	......	..	....
Numbers	RE	20/200	20	......	..	....
	LE	12/200	8	......	..	....
CASE 35		$-3.25 = -0.25 \times 165 = 20/20$		$-2.75 = -0.50 \times 160 = 20/20$		
Letters	RE	20/200	20	10/100	20	+ −
	LE	20/300	8	20/100	49	+41
Landolt	RE	17/200	14	10/200	3	−11
	LE	8/200	1	20/175	25	+24
E	RE	20/200	20	10/80 −2	23	+3
	LE	20/200	20	20/160 −1	28	+5
Numbers	RE	20/200 −1	14	10/70	34	+20
	LE	20/200 −1	14	20/200	20	+6
CASE 36		$-1.00 = -0.50 \times 30 = 20/15$		$-1.25 = 20/20$		
Letters	RE	20/70 −2	54	20/100 −1	37	−17
	LE	20/200	20	20/100	49	+29
Landolt	RE	20/150	31	20/150	31	+ −
	LE	15/200	11	20/150	31	+20
E	RE	20/160	29	20/120	41	+12
	LE	20/80	59	20/80 −2	56	−3
Numbers	RE	20/200 +1	37	20/100 −1	37	+ −
	LE	20/200 +1	37	20/100 −1	37	+ −
CASE 37		$-2.00 = -0.75 \times 130 = 20/20$		$-2.00 = 0.50 \times 180 = 20/15 -3$		
Letters	RE	20/400	3	20/70	64	+61
	LE	17/400	1	20/70 −1	60	+59
Landolt	RE	9/150	6	20/200	20	+14
	LE	9/200	2	15/200	11	+9
E	RE	15/200	11	20/120 −1	30	+19
	LE	12/200	8	20/120	41	+33
Numbers	RE	9/200	1	20/200 +1	37	+36
	LE	8/200	1	20/200 +1	37	+36
CASE 37		**Third Test**				
Letters	RE	20/200	20	......	..	....
	LE	20/100 −1	37	......	..	....
Landolt	RE	20/175 −1	23	......	..	....
	LE	20/175 −1	23	......	..	....
E	RE	20/120 −2	27	......	..	....
	LE	20/120 −2	27	......	..	....
Numbers	RE	20/100 −1	37	......	..	....
	LE	20/100	49	......	..	....
CASE 38		$-3.25 = 20/25$		$-3.25 = -0.50 \times 35 = 20/30 +2$		
Letters	RE	15/400	1	10/200	3	+2
	LE	15/400	1	10/70 −1	28	+27
Landolt	RE	8/200	1	9/200	1	+ −
	LE	8/200	1	10/175	5	+4
E	RE	8/200	1	10/80	38	+37
	LE	9/200	1	10/80 −1	28	+27
Numbers	RE	6/100 −1	6	10/70	34	+28
	LE	8/200	1	11/200	5	+4
CASE 39		$-3.00 = 20/20$		$-3.00 = -0.25 \times 90 = 20/20$		
Letters	RE	12/400	1	15/200	11	+10
	LE	20/400	3	15/200	11	+8
Landolt	RE	9/200	1	10/200	3	+2
	LE	10/200	3	10/100 −1	14	+11
E	RE	17/200	14	10/80	29	+15
	LE	9/200	1	10/80	29	+28
Numbers	RE	6/200	1	15/200 −1	6	+5
	LE	16/200	13	12/200	8	−5

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 40		$-7.00 = -1.00 \times 180 = 20/20$		$-7.00 = -1.00 \times 180 = 20/20$		
Letters	RE............	8/200	1	20/200	20	+19
	LE............	9/200	1	10/200	3	+2
Landolt	RE............	7/200	1	15/175 −1	11	+10
	LE............	5/200	1	10/175 −1	5	+4
E	RE............	5/200	1	10/80	29	+28
	LE............	5/200	1	10/80	29	+28
Numbers	RE............	5/200	1	15/200 −1	6	+5
	LE............	10/200	3	10/100 +2	48	+45
CASE 41		$-1.50 = -0.25 \times 175 = 20/20$		$-1.50 = -0.25 \times 180 = 20/20$		
Letters	RE............	14/200	10	20/40 −1	82	+72
	LE............	10/70 −1	28	20/100 −1	37	+9
Landolt	RE............	12/200	8	20/125	39	+31
	LE............	10/125	13	20/175	25	+12
E	RE............	17/160	24	20/60 +4	75	+51
	LE............	19/100	47	20/120 −1	30	−17
Numbers	RE............	17/100	41	20/50 −2	73	+32
	LE............	10/70	34	20/100 −2	35	+1
CASE 41		**Third Test**				
Letters	RE............	20/200	20	......	..	....
	LE............	20/200	20	......	..	....
Landolt	RE............	10/200	3	......	..	....
	LE............	20/200	20	......	..	....
E	RE............	20/200	20	......	..	....
	LE............	20/120 −1	34	......	..	....
Numbers	RE............	20/200 −1	12	......	..	....
	LE............	20/200	20	......	..	....
CASE 42		$-2.75 = 20/15 -2$		$-2.75 = -0.25 \times 170 = 20/15 -3$		
Letters	RE............	20/100 −1	37	20/200	20	−17
	LE............	10/100	20	15/100	33	+13
Landolt	RE............	13/200	9	10/85 −1	23	+14
	LE............	16/200	13	15/200	11	−2
E	RE............	20/200	20	20/200	20	+−
	LE............	15/200	11	20/200	20	+9
Numbers	RE............	18/200	17	20/200	20	+3
	LE............	10/100 −1	14	15/100	33	+19
CASE 44		$-2.75 = -0.25 \times 180 = 20/20$		$-2.25 = -0.25 \times 70 = 20/20$		
Letters	RE............	15/200	11	20/200	20	+9
	LE............	20/200	20	20/200 +1	37	+17
Landolt	RE............	10/200	3	10/175	5	+2
	LE............	7/200	1	10/60	41	+40
E	RE............	11/200	5	20/120	41	+36
	LE............	17/200	14	10/30 +1	71	+57
Numbers	RE............	18/200	17	20/200	20	+3
	LE............	16/200	13	20/200	20	+7
CASE 45		$-0.50 = 20/20$		$-0.75 = 20/20$		
Letters	RE............	20/30	92	20/50	76	−16
	LE............	20/50 −2	73	20/40 −2	81	+8
Landolt	RE............	20/70	64	20/125	39	−25
	LE............	20/100 −1	44	20/125 −1	35	−9
E	RE............	20/40	84	20/50 +2	80	−4
	LE............	20/50	76	20/50	76	+−
Numbers	RE............	20/50	76	20/40 −3	80	+4
	LE............	20/40	84	20/50 +2	80	−4
CASE 46		$-4.00 = -0.50 \times 165 = 20/20$		$-4.00 = -0.50 \times 180 = 20/20$		
Letters	RE............	15/200	11	10/200 −1	5	−6
	LE............	20/200	20	17/200	14	−6
Landolt	RE............	8/200	1	10/150	8	+7
	LE............	19/200	19	10/150	8	−11
E	RE............	8/160	3	10/120 +2	12	+9
	LE............	15/160	20	10/80	29	+9
Numbers	RE............	10/100 −1	14	10/70 +2	37	+23
	LE............	15/200	11	10/100	20	+9
CASE 48		$-6.00 = 20/20 -1$		$-5.25 = 20/20 -1$		
Letters	RE............	20/300	8	10/200	3	−5
	LE............	20/400	3	10/70	34	+31
Landolt	RE............	7/200	1	10/200	3	+2
	LE............	7/200	1	10/125 −1	11	+10
E	RE............	11/200	5	10/160	7	+2
	LE............	12/200	8	10/120	14	+6
Numbers	RE............	8/200	1	10/70 −1	28	+27
	LE............	10/200	3	10/70 −1	28	+25

ALAN C. WOODS

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 49		$-3.75 = -0.50 \times 180 = 20/20$		$-2.00 = -0.50 \times 180 = 20/20$		
Letters	RE..........	20/400	3	10/200	3	+ −
	LE..........	20/400	3	10/100	37	+34
Landolt	RE..........	8/200	1	10/200	3	+2
	LE..........	9/175	4	10/150	8	+4
E	RE..........	7/200	1	10/120 +1	17	+16
	LE..........	8/200	1	10/80 −1	24	+23
Numbers	RE..........	7/100	9	10/200	3	−6
	LE..........	8/200	1	10/70 −1	28	+27
CASE 50		$-2.50 = -0.75 \times 5 = 20/20$		$-2.25 = -0.50 \times 180 = 20/30 + 2$		
Letters	RE..........	18/200	17	20/100 −1	37	+20
	LE..........	18/200	17	20/200	20	+3
Landolt	RE..........	12/200	8	20/175 −1	23	+15
	LE..........	12/200	8	15/200	11	+3
E	RE..........	20/160	29	20/160	29	+ −
	LE..........	20/160	29	20/200	20	−9
Numbers	RE..........	15/200	11	20/100	49	+38
	LE..........	15/200	11	15/100	33	+22
CASE 51		$-3.75 = -0.50 \times 180 = 20/15$		$-3.75 = -0.75 \times 180 = 20/15 -4$		
Letters	RE..........	12/200	8	10/200	3	−5
	LE..........	10/200	3	10/100	20	+17
Landolt	RE..........	10/200	3	10/175 −1	4	+1
	LE..........	8/200	1	10/150	8	+7
E	RE..........	15/200	11	10/120	14	+3
	LE..........	12/200	8	10/80	29	+21
Numbers	RE..........	12/200	8	10/200 +1	9	+1
	LE..........	6/200	1	10/200 +1	9	+8
CASE 52		$-5.00 = -2.25 \times 15 = 20/30 +3$		$-4.00 = -2.50 \times 165 = 20/20 -3$		
Letters	RE..........	15/400	1	10/200	3	+2
	LE..........	20/400	3	20/100 −1	37	+34
Landolt	RE..........	9/200	1	10/125	13	+12
	LE..........	12/200	8	20/200	20	+12
E	RE..........	8/200	1	20/160 −2	23	+22
	LE..........	8/200	1	20/160 +1	38	+37
Numbers	RE..........	8/200	1	20/200	20	+19
	LE..........	10/200	3	20/200 +1	37	+34
CASE 52		**Third Test**				
Letters	RE..........	10/200	3	......	..	....
	LE..........	10/200	3	......	..	....
Landolt	RE..........	7/175	1	......	..	....
	LE..........	10/175	5	......	..	....
E	RE..........	10/160	6	......	..	....
	LE..........	10/120	9	......	..	....
Numbers	RE..........	10/200	3	......	..	....
	LE..........	10/200	3	......	..	....
CASE 53		$-4.00 = 20/20$		$-4.00 = 20/20$		
Letters	RE..........	10/200	3	20/70	64	+61
	LE..........	8/200	1	20/70 +1	66	+65
Landolt	RE..........	15/200	11	20/85	56	+45
	LE..........	10/200	3	20/125	39	+36
E	RE..........	14/200	10	20/160 +1	38	+28
	LE..........	9/200	1	20/160	29	+28
Numbers	RE..........	12/200	8	20/100 +2	49	+41
	LE..........	10/200	3	20/100	59	+56
CASE 54		$-1.50 = 20/15$		$-1.25 = 20/15$		
Letters	RE..........	20/50 +1	78	20/50	76	−2
	LE..........	20/50 +2	80	20/50 +1	78	−2
Landolt	RE..........	20/125	39	20/100	49	+10
	LE..........	20/80	56	20/85	56	+ −
E	RE..........	20/60	70	20/80	59	−11
	LE..........	20/50	76	20/40 −3	79	+3
Numbers	RE..........	20/70 −1	60	20/70 +1	66	+6
	LE..........	20/70 +1	66	20/50 +2	80	+14
CASE 55		$-4.00 = -0.25 \times 90 = 20/20$		$-3.75 = -0.50 \times 90 = 20/20$		
Letters	RE..........	20/100	49	20/100 −1	37	−12
	LE..........	20/200	20	10/200	20	+ −
Landolt	RE..........	10/200	3	15/200	11	+8
	LE..........	10/200	3	10/175	5	+2
E	RE..........	20/200	20	20/160	29	+9
	LE..........	20/120	41	10/120	14	−27
Numbers	RE..........	20/200 −1	14	12/200	8	−6
	LE..........	18/200	17	10/100 +1	37	+20

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

	Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 56	$-1.25 = -2.25 \times 90 = 20/30$		$-2.00 = -3.50 \times 165 = 20/40$		
Letters RE..........	......	..	......	..	....
LE..........	20/100	49	10/100	20	−29
Landolt RE..........	......	..	......	..	....
LE..........	20/200	20	10/175	5	−15
E RE..........	......	..	......	..	....
LE..........	20/200	20	10/120	14	−6
Numbers RE..........	......	..	......	..	....
LE..........	20/300	8	7/100 −1	14	+6
CASE 57	$-2.00 = 20/20$		$-4.00 = -0.50 \times 180 = 20/20$		
Letters RE..........	20/200	20	20/50 −2	73	+53
LE..........	9/200	1	20/70 −1	60	+59
Landolt RE..........	20/200	20	20/85	56	+36
LE..........	8/200	1	20/50	76	+75
E RE..........	20/120	41	20/30 −3	88	+47
LE..........	12/200	8	20/40 −2	81	+73
Numbers RE..........	20/100	49	20/50 −2	73	+24
LE..........	12/200	8	20/70	64	+56
CASE 57	**Third Test**				
Letters RE..........	20/70	64	......	..	....
LE..........	20/200	20	......	..	....
Landolt RE..........	10/150	8	......	..	....
LE..........	10/175	5	......	..	....
E RE..........	20/80	50	......	..	....
LE..........	10/160	6	......	..	....
Numbers RE..........	20/50 −2	73	......	..	....
LE..........	10/200	3	......	..	....
CASE 58	$-1.00 = -0.25 \times 180 = 20/20$		$-0.50 = 20/20$		
Letters RE..........	20/70 −1	60	20/40 +2	87	+27
LE..........	20/30	92	20/40 −1	82	−10
Landolt RE..........	20/125	39	20/200	20	−19
LE..........	20/50	76	20/60 −1	68	−8
E RE..........	20/80 +2	62	20/50	76	+14
LE..........	20/25 −3	92	20/30 −1	91	−1
Numbers RE..........	20/100 −1	37	20/40 −1	82	+45
LE..........	20/30 −3	88	20/30	92	+4
CASE 59	$-3.00 = 20/20$		$-3.00 = -0.25 \times 180 = 20/20$		
Letters RE..........	15/200	11	10/100	20	+9
LE..........	20/200	20	10/100 +1	37	+17
Landolt RE..........	10/200	3	10/175	5	+2
LE..........	10/200	3	10/175	5	+2
E RE..........	20/200	20	10/80	29	+9
LE..........	20/200	20	10/80 −1	24	+4
Numbers RE..........	10/200	3	10/200	3	+−
LE..........	10/200	3	10/100 −1	14	+11
CASE 60	$-1.00 = -0.25 \times 15 = 20/20$		$-2.25 = -0.25 \times 90 = 20/20$		
Letters RE..........	20/100 +1	54	20/50 −1	75	+21
LE..........	20/200	20	20/50	77	+57
Landolt RE..........	18/200	17	20/60 −1	68	+51
LE..........	13/200	9	20/85	56	+47
E RE..........	20/80	59	20/80 −1	55	−4
LE..........	20/200	20	20/120	41	+21
Numbers RE..........	20/70	64	20/100	49	−15
LE..........	20/200	20	20/100	49	+29
CASE 60	**Third Test**				
Letters RE..........	20/70	64	......	..	....
LE..........	10/70 +1	40	......	..	....
Landolt RE..........	20/150	31	......	..	....
LE..........	5/175	1	......	..	....
E RE..........	20/80	59	......	..	....
LE..........	20/160	29	......	..	....
Numbers RE..........	20/70 −1	59	......	..	....
LE..........	10/70	34	......	..	....
CASE 63	$-1.75 = -0.25 \times 180 = 20/20$		$-1.50 = -0.25 \times 180 = 20/20$		
Letters RE..........	20/100 +1	54	20/40 −1	82	+28
LE..........	20/100	49	20/50 +2	80	+31
Landolt RE..........	20/200	20	20/85 +1	61	+41
LE..........	20/125 −1	23	20/85 −1	55	+32
E RE..........	20/80	59	20/30 −5	86	+27
LE..........	20/60	70	20/50	76	+6
Numbers RE..........	20/200 +1	37	20/30 −3	88	+51
LE..........	20/100	49	15/70 +2	56	+7

ALAN C. WOODS

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 63		**Third Test**				
Letters	RE..........	20/50 −3	72	......	..	....
	LE..........	20/50 −3	72	......	..	....
Landolt	RE..........	20/100 −1	37	......	..	....
	LE..........	20/85	56	......	..	....
E	RE..........	20/60 −2	66	......	..	....
	LE..........	20/50 −2	74	......	..	....
Numbers	RE..........	20/50 −3	72	......	..	....
	LE..........	20/70 −1	59	......	..	....
CASE 64		−7.50 = 20/20 −4		−7.00 = −0.75 ×80 = 20/20 −1		
Letters	RE..........	7/100 −1	7	10/200	3	−4
	LE..........	5/100	3	10/100 −1	14	+11
Landolt	RE..........	7/200	1	10/200	3	+2
	LE..........	5/125	1	10/175	5	+4
E	RE..........	10/200	3	10/160	7	+4
	LE..........	8/160	3	10/160	14	+11
Numbers	RE..........	10/200	3	10/200	3	+ −
	LE..........	5/100	3	10/200	3	+ −
CASE 65		−4.00 = 20/15 −4		−3.50 = 20/15 −1		
Letters	RE..........	10/100	20	10/50 −2	35	+15
	LE..........	9/100	35	10/70 −1	28	−7
Landolt	RE..........	10/175	5	10/125	8	+3
	LE..........	17/200	14	10/85	26	+12
E	RE..........	6/50 −3	41	10/60 −2	24	−17
	LE..........	18/200	17	10/60	41	+24
Numbers	RE..........	14/200 −1	6	10/70 +1	41	+35
	LE..........	17/200 −1	8	10/70	34	+26
CASE 66		−3.50 = 20/20		−3.00 = −0.50 ×20 = 20/15		
Letters	RE..........	10/100		15/100 +1	42	+22
	LE..........	10/100		15/70 −1	51	+31
Landolt	RE..........	15/150	20	15/175	11	−9
	LE..........	15/175	16	15/150	20	+4
E	RE..........	20/120 −1	30	20/120	41	+11
	LE..........	20/160	29	20/120 +2	45	+16
Numbers	RE..........	20/200 −1	14	20/70 −1	60	+46
	LE..........	15/100 −1	27	20/70 +2	69	+42
CASE 67		−9.50 = 2.00 ×50 = 20/50		−8.50 = −4.50 ×140 = 20/50 +2		
Letters	RE..........	4/70	5	10/100	20	+15
	LE..........	5/100	3	10/100 −1	14	+11
Landolt	RE..........	4/125	1	10/175	5	+4
	LE..........	4/85	1	10/200	3	+2
E	RE..........	3/80	1	10/120	14	+13
	LE..........	5/80	8	10/80 −1	24	+16
Numbers	RE..........	5/200	1	10/200	3	+2
	LE..........	4/70 −1	4	10/100 −1	14	+10
CASE 68		−3.62 = −1.00 ×10 = 20/15 −2		−3.75 = −1.00 ×170 = 20/20 +2		
Letters	RE..........	10/200	3	10/70 −1	28	+25
	LE..........	7/100	10	10/70 −1	28	+18
Landolt	RE..........	12/125 −1	14	10/85	26	+12
	LE..........	12/125	20	10/70 −1	28	+8
E	RE..........	20/160 −1	24	10/80	29	+5
	LE..........	20/160 −1	24	10/60 −2	24	+ −
Numbers	RE..........	20/200 −1	14	10/70 +2	47	+33
	LE..........	20/200 −1	14	10/70 +1	41	+27
CASE 69		−1.50 = −1.25 ×15 = 20/20 +4		−1.50 = −1.00 ×165 = 20/20 −1		
Letters	RE..........	20/200	20	20/200 +1	37	+17
	LE..........	17/100	34	15/200	11	−23
Landolt	RE..........	13/175	10	15/200	11	+1
	LE..........	18/175	14	20/175	23	+9
E	RE..........	20/160 −1	24	20/160	29	+5
	LE..........	20/160	29	20/120	41	+12
Numbers	RE..........	17/100 −1	34	20/200 +1	37	+3
	LE..........	20/200	20	20/200	20	+ −
CASE 70		−1.25 = −0.50 ×90 = 20/20 +4		−1.25 = −0.50 ×90 = 20/20		
Letters	RE..........	20/100 −1	37	20/70 +1	66	+29
	LE..........	20/100 −1	37	20/70 −1	60	+23
Landolt	RE..........	20/125	39	20/125	39	+ −
	LE..........	20/175	25	20/125	39	+14
E	RE..........	20/120 +2	46	20/120	41	−5
	LE..........	20/120	41	20/80	59	+18
Numbers	RE..........	20/200	20	20/70 −1	60	+40
	LE..........	20/200 +1	37	20/70 −1	60	+23

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

	Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 70	**Third Test**				
Letters RE............	20/70 +1	69	......	..	....
LE............	20/70 −1	59	......	..	....
Landolt RE............	20/100 −1	37	......	..	....
LE............	20/125 −1	30	......	..	....
E RE............	20/80	59	......	..	....
LE............	20/80 +2	62	......	..	....
Numbers RE............	20/70	64	......	..	....
LE............	20/70 +1	69	......	..	....
CASE 71	−6.50 = −0.50 ×90 = 20/20 +3		−6.50 = −0.50 ×90 = 20/20		
Letters RE............	7/100 −1	8	15/100 −1	27	+19
LE............	7/70 −1	14	10/100	20	+6
Landolt RE............	8/175	1	10/200	3	+2
LE............	6/125	2	10/175 −1	3	+1
E RE............	10/80 −2	23	10/120	9	−14
LE............	6/120	3	10/160	15	+12
Numbers RE............	10/200	3	15/100	33	+30
LE............	10/200	3	10/200 +1	5	+2
CASE 72	−2.25 = −0.75 ×180 = 20/20		−2.50 = −0.50 ×180 = 20/20		
Letters RE............	20/200	20	20/200	20	+ −
LE............	20/200	20	20/200	20	+ −
Landolt RE............	20/200	20	15/200	11	−9
LE............	20/200	20	15/200	11	−9
E RE............	20/160	29	20/160 −1	24	−5
LE............	20/160 −1	24	20/120	41	+17
Numbers RE............	20/200 +1	37	20/200 +1	37	+ −
LE............	20/200	20	20/200	20	+ −
CASE 74	−2.50 = −0.25 ×180 = 20/20 −1		−1.75 = −0.52 ×5 = 20/20		
Letters RE............	10/100 +1	37	20/200	20	−17
LE............	15/100 −1	27	20/70 −1	60	+33
Landolt RE............	15/200	11	20/175	25	+14
LE............	15/175	16	20/150	31	+15
E RE............	10/60 −2	24	20/120	41	+17
LE............	15/80 −2	35	20/80	59	+24
Numbers RE............	15/100 −1	27	20/200 +1	37	+10
LE............	15/100 −1	27	20/100 −1	37	+10
CASE 75	−4.00 = −3.00 ×180 = 20/20		−5.50 = −2.50 ×180 = 20/30 +1		
Letters RE............	5/100	3	10/100 −1	14	+11
LE............	6/200	1	10/200	3	+2
Landolt RE............	6/175 −1	1	10/200	3	+2
LE............	5/175	1	6/200	1	+ −
E RE............	10/160 −1	4	10/80 −1	24	+20
LE............	5/160	1	10/160	7	+6
Numbers RE............	10/200 −1	1	8/200	3	+2
LE............	6/200 −1	1	1/200	3	+2
CASE 76	−0.50 = −0.25 ×135 = 20/20		−0.75 = 20/15 −4		
Letters RE............	20/30	92	20/40 +2	87	−5
LE............	20/40 +3	89	20/40	84	−5
Landolt RE............	20/85	56	20/85	56	+ −
LE............	20/85	56	20/85	56	+ −
E RE............	20/30 +1	93	20/40 −1	82	−11
LE............	20/40	84	20/40 +1	85	+1
Numbers RE............	20/30 −2	90	20/40 −3	79	−11
LE............	20/40 −3	79	20/40 −2	81	+2
CASE 77	−0.50 ×90 = 20/20		−0.50 = 20/15		
Letters RE............	20/40 +3	89	20/70 +1	66	−23
LE............	20/40 −2	81	20/40 −2	81	+ −
Landolt RE............	20/45	80	20/85 +2	60	−20
LE............	20/60 −1	68	20/70	64	−4
E RE............	20/40 −2	61	20/60 +3	74	−7
LE............	20/60	70	20/40	89	+19
Numbers RE............	20/30 −3	88	20/70 +1	66	−22
LE............	20/40 −2	81	20/70	64	−17
CASE 78	−6.25 = 20/20		−5.50 = −0.75 ×180 = 20/25		
Letters RE............	6/100 −1	3	20/100 +1	54	+51
LE............	8/100	13	15/100	33	+20
Landolt RE............	6/150	1	20/175	25	+24
LE............	6/125 −1	3	10/125	13	+10
E RE............	6/80	7	20/80 +2	62	+55
LE............	10/160	7	10/80 −2	23	+16
Numbers RE............	8/100	13	20/100	49	+36
LE............	7/100 −1	6	10/100 +1	37	+31

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 79		$-1.75 = -0.25 \times 180 = 20/20$		$-1.50 = -0.50 \times 180 = 20/20$		
Letters	RE..........	20/100	49	20/40	84	+35
	LE..........	20/100 +1	54	20/40 −2	81	+27
Landolt	RE..........	20/175 −1	23	20/70 −1	60	+37
	LE..........	20/125	39	20/200	20	−19
E	RE..........	20/80	59	20/20	100	+41
	LE..........	20/80	59	20/80	59	+ −
Numbers	RE..........	20/200 −1	37	20/60 −1	68	+31
	LE..........	20/50 −2	73	20/60 −1	68	−5
CASE 79		**Third Test**				
Letters	RE..........	20/200	20	......	..	....
	LE..........	15/200	11	......	..	....
Landolt	RE..........	20/175 −1	23	......	..	....
	LE..........	20/175	25	......	..	....
E	RE..........	10/120 +1	45	......	..	....
	LE..........	20/80 +2	62	......	..	....
Numbers	RE..........	18/200	17	......	..	....
	LE..........	20/100 −1	37	......	..	....
CASE 81		$-2.00 = 20/15$		$-2.00 = 20/15$		
Letters	RE..........	20/50	76	20/40 +1	86	+10
	LE..........	20/70	64	20/70 +1	66	+2
Landolt	RE..........	20/100	49	20/150	31	−18
	LE..........	20/150 +1	40	20/150	31	−9
E	RE..........	20/80	59	20/40	84	+25
	LE..........	20/80 −2	56	20/80	59	+3
Numbers	RE..........	20/70	64	20/50 −2	73	+9
	LE..........	20/100 +1	54	20/100	49	−5
CASE 83		$-3.50 = 20/20$		$-3.25 = 20/20$		
Letters	RE..........	20/40 −1	82	15/100 −1	27	−55
	LE..........	20/200	20	15/100 +1	39	+19
Landolt	RE..........	20/85	61	15/125 −1	23	−38
	LE..........	20/125	39	15/175	16	−23
E	RE..........	20/80	59	15/120	23	−36
	LE..........	20/120	41	15/80 +2	64	+23
Numbers	RE..........	20/50	76	15/200 −1	7	−69
	LE..........	20/50	76	15/200 −1	7	−69
CASE 84		$-0.75 = 20/20$		$-0.50 = 20/20$		
Letters	RE..........	20/30	92	20/20 −2	90	−2
	LE..........	20/30	92	20/150	76	−16
Landolt	RE..........	20/50	76	20/70 −1	60	−16
	LE..........	20/40	84	20/70 −1	60	−24
E	RE..........	20/30	92	20/40	84	−8
	LE..........	20/25	96	20/30 +2	95	−1
Numbers	RE..........	20/30	92	20/40 −1	82	−10
	LE..........	20/30	92	20/40	84	−8
CASE 85		$-3.25 = 20/20$		$-2.00 = 20/20$		
Letters	RE..........	20/200	20	10/100 −1	14	−6
	LE..........	20/100	49	20/20 −1	60	+11
Landolt	RE..........	15/200	11	10/100 −1	14	+3
	LE..........	18/200	17	20/125 −1	23	+6
E	RE..........	20/200 +1	57	10/80 −1	24	−33
	LE..........	20/120	41	20/80	59	+18
Numbers	RE..........	10/200	3	10/100 +1	37	+34
	LE..........	20/100	49	20/100 +1	54	+5
CASE 86		$-5.50 = -0.50 \times 180 = 20/20$		$-5.25 = 0.50 \times 180 = 20/20$		
Letters	RE..........	8/200	1	10/200	3	+2
	LE..........	10/200	3	10/200	3	+ −
Landolt	RE..........	5/200	1	10/200	3	+2
	LE..........	6/200	1	10/175 −1	4	+3
E	RE..........	7/200	1	10/160 −1	5	+4
	LE..........	7/200	1	10/160 −1	5	+4
Numbers	RE..........	6/200	1	10/200 −1	1	+ −
	LE..........	7/200	1	10/200	3	+2
CASE 87		$-3.50 = -0.25 \times 90 = 20/20$		$-3.75 = 20/15$		
Letters	RE..........	9/200	1	10/200	3	+2
	LE..........	5/70 −1	5	10/100 −1	14	+9
Landolt	RE..........	6/200	1	5/200	1	+ −
	LE..........	5/200	1	10/175	5	+4
E	RE..........	11/160 −1	5	10/200	3	−2
	LE..........	12/160	5	10/120	15	+10
Numbers	RE..........	10/200 −1	1	10/200 +1	14	+13
	LE..........	10/200 −1	1	10/200 +1	14	+13

CHART IX.—Continued.

Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 88		$-3.00 = -0.75 \times 180 = 20/20 + 4$		$-2.50 = -0.62 \times 180 = 20/20 + 4$		
Letters	RE..........	15/200	11	15/100	33	+22
	LE.........	10/100 −1	14	20/100	49	+35
Landolt	RE..........	7/125	5	10/200	3	−2
	LE..........	10/175	5	20/200	20	+15
E	RE.........	10/160	14	15/160	10	−4
	LE..........	10/120	15	20/120 −1	34	+19
Numbers	RE..........	10/200	3	15/200 +1	15	+12
	LE..........	10/70	34	20/100 −1	37	+3
CASE 89		$-2.50 = 20/15 - 1$		$-2.75 = -0.25 \times 180 = 20/15$		
Letters	RE..........	15/200	11	20/40 −2	81	+70
	LE..........	15/100 +1	37	20/50	76	+39
Landolt	RE..........	10/175	5	20/70 −1	60	+55
	LE..........	10/175 −1	4	20/85	56	+52
E	RE..........	20/200	20	20/50 −2	73	+53
	LE..........	15/200	11	20/40 −3	79	+68
Numbers	RE..........	10/70	34	20/50 −3	71	+37
	LE..........	10/200 +1	12	20/50 −2	73	+61
CASE 90		$-4.25 = 20/20$		$-2.00 = -0.50 \times 90 = 20/15$		
Letters	RE..........	10/200	3	10/200	3	+ −
	LE..........	15/100	33	20/200	20	−13
Landolt	RE..........	6/200	5	10/175 −1	4	−1
	LE..........	10/175	5	20/100	49	+44
E	RE..........	12/160	27	10/120	14	−13
	LE..........	15/80 −2	27	20/80	58	+31
Numbers	RE..........	10/200	3	10/200	3	+ −
	LE..........	15/100 −1	27	20/100 −1	37	+10
CASE 90		**Third Test**				
Letters	RE..........	12/200	8	......	..	....
	LE..........	17/100	34	......	..	....
Landolt	RE..........	10/175	5	......	..	....
	LE..........	10/175	5	......	..	....
E	RE..........	10/160	7	......	..	....
	LE..........	20/200	20	......	..	....
Numbers	RE..........	12/200	8	......	..	....
	LE..........	20/200	20	......	..	....
CASE 91		$-4.25 = 20/20$		$-4.50 = 20/20$		
Letters	RE..........	10/200	3	20/100	49	+46
	LE..........	10/200	3	10/100	20	+17
Landolt	RE..........	5/100	3	15/200	11	+8
	LE..........	5/100	3	12/200	8	+5
E	RE..........	10/120	14	20/120 −1	34	+20
	LE..........	10/120 −1	11	10/120	14	+3
Numbers	RE..........	20/200	20	20/100	49	+29
	LE..........	20/200 +1	37	10/200	3	−34
CASE 93		$-4.25 = -0.25 \times 90 = 20/20$		$-4.00 = -0.25 \times 90 = 20/20$		
Letters	RE..........	8/100 −1	8	20/200	20	+12
	LE..........	12/100 −1	23	5/50	20	−3
Landolt	RE..........	13/200	9	5/85	5	−4
	LE..........	13/175	10	5/100 −1	1	−9
E	RE..........	13/120 +1	35	10/80 −1	24	−11
	LE..........	10/200 +1	5	10/120 +1	17	+12
Numbers	RE..........	5/100	3	12/200	8	+5
	LE..........	10/200	3	10/200 +1	14	+11
CASE 94		$-2.50 = -0.50 \times 180 = 20/15$		$-2.25 = 20/20$		
Letters	RE..........	20/200	20	20/70	64	+44
	LE..........	20/200	20	20/70 −1	60	+40
Landolt	RE..........	12/200	8	20/125	39	+31
	LE..........	10/85	26	20/85	56	+30
E	RE..........	15/200	11	20/60 +3	74	+63
	LE..........	20/120 −2	28	20/60 +2	72	+44
Numbers	RE..........	15/200 −1	7	20/100 −1	37	+30
	LE..........	20/100 −1	37	20/100 −1	37	+ −
CASE 95		$-1.50 = -0.50 \times 90 = 20/30 + 4$		$-2.00 = -0.25 \times 90 = 20/30$		
Letters	RE..........	20/200	20	25/40 +1	86	+66
	LE..........	10/70 −1	28	20/50 +1	78	+50
Landolt	RE..........	10/125 −1	10	20/125	39	+29
	LE..........	10/125 −1	10	20/150	31	+21
E	RE..........	20/160	29	20/50	76	+47
	LE..........	10/60	41	20/60 +1	71	+30
Numbers	RE..........	15/200	11	20/40 +1	86	+75
	LE..........	10/100 −1	14	20/70 −1	60	+46

CHART IX.—Continued.
Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 96		−1.25 = −0.50 ×20 = 20/20		−1.50 = −0.50 ×135 = 20/20 +2		
Letters	RE..........	20/70	64	20/70	64	+ −
	LE..........	20/100	49	20/50	77	+28
Landolt	RE..........	20/175 −1	23	20/100	49	+26
	LE..........	20/200	20	20/85	56	+36
E	RE..........	20/60 +2	72	20/60 +3	74	+2
	LE..........	20/80	59	20/50	77	+18
Numbers	RE..........	20/70 +2	69	20/40 −2	81	+12
	LE..........	20/100	49	20/40 −3	79	+30
CASE 97		−1.00 = −0.25 ×90 = 20/15		−1.00 = −0.25 ×180 = 20/15		
Letters	RE..........	20/100	49	20/20 −3	97	+48
	LE..........	20/100 +1	54	20/20 −4	96	+42
Landolt	RE..........	20/175	25	20/85	56	+31
	LE..........	20/175	25	20/60	70	+45
E	RE..........	20/80	59	20/40	84	+25
	LE..........	20/80	59	20/30	97	+38
Numbers	RE..........	20/200 +1	37	20/30 −2	90	+53
	LE..........	20/100 −1	37	20/40 +2	87	+50
CASE 97		**Third Test**				
Letters	RE..........	20/30	92	......	..	....
	LE..........	20/70	64	......	..	....
Landolt	RE..........	20/70 −1	60	......	..	....
	LE..........	20/100 +1	54	......	..	....
E	RE..........	20/50 +1	78	......	..	....
	LE..........	20/60 +1	70	......	..	....
Numbers	RE..........	20/100	49	......	..	....
	LE..........	20/70	64	......	..	....
CASE 98		−0.50 ×180 = 20/20		−2.75 = −0.75 ×180 = 20/20		
Letters	RE..........	20/30	92	20/20 +1	100	+8
	LE..........	10/200	3	10/100 +1	37	+34
Landolt	RE..........	20/50 −1	75	20/30	92	+17
	LE..........	8/200	1	10/125	13	+12
E	RE..........	20/30 +2	95	20/20	100	+5
	LE..........	15/200	11	10/50 −2	27	+16
Numbers	RE..........	20/30	92	20/20 −2	98	+6
	LE..........	8/200	3	10/100 +1	37	+34
CASE 99		−0.50 = −0.50 ×175 = 20/20		−0.75 = −0.25 ×180 = 20/15 −1		
Letters	RE..........	20/50	77	20/30 +2	95	+18
	LE..........	20/50	77	20/20 −3	97	+20
Landolt	RE..........	20/70	64	20/45 +1	82	+18
	LE..........	20/70	64	20/40 −1	82	+18
E	RE..........	20/40 −1	82	20/30 +2	95	+13
	LE..........	20/30	92	20/30 −3	88	−4
Numbers	RE..........	20/30	92	20/40 −2	81	−11
	LE..........	20/30 −3	88	20/40 −2	81	−7
CASE 99		**Third Test**				
Letters	RE..........	20/40	84	......	..	....
	LE..........	20/40 +2	86	......	..	....
Landolt	RE..........	20/60	70	......	..	....
	LE..........	20/50	76	......	..	....
E	RE..........	20/30	92	......	..	....
	LE..........	20/40	84	......	..	....
Numbers	RE..........	20/40 +3	89	......	..	....
	LE..........	20/40 −1	82	......	..	....
CASE 100		−0.37 = 20/15 −3		−0.37 = −0.25 ×25 = 20/20		
Letters	RE..........	20/40 +2	87	20/30 −2	90	+3
	LE..........	20/30	92	20/20 −2	98	+6
Landolt	RE..........	20/60 +1	72	20/50	77	+5
	LE..........	20/50 −1	75	20/45	80	+5
E	RE..........	20/30 +3	96	20/30 −3	88	−8
	LE..........	20/25	96	20/30 −1	91	−5
Numbers	RE..........	20/30 −2	90	20/40	84	−6
	LE..........	20/30 +1	93	20/30 −2	90	−3
CASE 101		−2.25 = −0.50 ×95 = 20/15 −4		−2.75 = −0.50 ×85 = 20/20 +3		
Letters	RE..........	20/200	20	20/200	20	+ −
	LE..........	10/100	20	15/200	11	−9
Landolt	RE..........	20/200	20	15/200	11	−9
	LE..........	10/175	5	15/200	11	+6
E	RE..........	20/200	20	20/120 +1	45	+25
	LE..........	10/160 −1	4	15/120	29	+25
Numbers	RE..........	20/200	20	20/200	20	+ −
	LE..........	7/70	20	15/200	11	−9
CASE 103		−4.00 = −0.75 ×180 = 20/20		−4.50 = −0.50 ×175 = 20/20 −2		
Letters	RE..........	10/200	3	20/70 −1	60	+57
	LE..........	7/100	9	10/70 −1	28	+19
Landolt	RE..........	7/200	1	20/175	25	+24
	LE..........	7/175	1	10/100 −1	14	+13
E	RE..........	7/120	5	20/120	41	+36
	LE..........	10/160 +1	15	10/50	49	+34
Numbers	RE..........	10/200 −1	1	20/100	49	+48
	LE..........	7/200 +1	1	10/70 +2	46	+45

CHART IX.—Continued.
Results of Visual Acuity Tests and % Evaluation of Vision.

	Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 104	$-2.25 = -0.37 \times 90 = 20/15 -3$				
Letters RE...........	......	..	..	..	....
LE...........	15/200 +1	12	20/70 −1	60	+48
Landolt RE...........	......	..	..	..	....
LE...........	15/200	11	20/150	31	+20
E RE...........	......	..	..	..	....
LE...........	15/200	11	20/120 −1	34	+23
Numbers RE...........	......	..	..	..	....
LE...........	15/200	11	20/100 +1	54	+43
CASE 105	$-1.25 = -0.75 \times 180 = 20/20$		$-0.75 = -0.75 \times 180 = 20/20$		
Letters RE...........	20/100	49	20/70 −1	60	+11
LE...........	20/50	77	20/70 −1	60	−17
Landolt RE...........	20/175	25	20/100	49	+24
LE...........	20/85	56	20/125	39	−17
E RE...........	20/160 +1	24	20/50 +2	80	+56
LE...........	20/60	70	20/60 +3	74	+4
Numbers RE...........	20/100 −1	37	20/50 +1	78	+41
LE...........	20/40 −3	80	20/100 −1	37	−43
CASE 106	$-2.75 = 20/15 -3$		$-2.00 = -0.25 \times 180 = 20/20 +4$		
Letters RE...........	19/200	19	20/100 −1	37	+18
LE...........	11/100	22	15/100 +1	39	+17
Landolt RE...........	15/175	15	20/125	39	+24
LE...........	10/175	4	15/100	33	+29
E RE...........	20/200	20	20/120 +1	45	+25
LE...........	10/80 −2	23	15/80 −2	40	+17
Numbers RE...........	20/200 −1	14	20/200	20	+6
LE...........	12/200	8	20/100	49	+41
CASE 107	$-1.75 = -0.50 \times 180 = 20/20$		$-2.00 = -0.25 \times 180 = 20/20$		
Letters RE...........	20/200	20	20/70 −1	60	+40
LE...........	20/200	20	20/70 −1	60	+40
Landolt RE...........	10/100 −1	14	20/150	31	+17
LE...........	10/100 −1	14	20/150 +1	42	+28
E RE...........	20/200 +1	37	20/80	59	+22
LE...........	20/100	49	20/80 −2	56	+7
Numbers RE...........	10/200 +1	6	20/100 −1	37	+31
LE...........	10/100 +2	27	20/70 −2	54	+27
CASE 107	**Third Test**				
Letters RE...........	20/70 −2	54	......	..	....
LE...........	20/70	64	......	..	....
Landolt RE...........	20/125 −1	30	......	..	....
LE...........	20/85 −1	55	......	..	....
E RE...........	20/60 −4	67	......	..	....
LE...........	20/50 −1	72	......	..	....
Numbers RE...........	20/70 −3	52	......	..	....
LE...........	20/70 −1	59	......	..	....
CASE 108	$-0.37 = 20/15$		$-0.62 = 20/15$		
Letters RE...........	20/20 −1	99	20/30 −2	90	−9
LE...........	20/30 +3	96	20/40 −3	79	−17
Landolt RE...........	20/40 +1	86	20/45	80	−6
LE...........	20/45	80	20/60	70	−10
E RE...........	20/20 +3	100	20/25	96	−4
LE...........	20/25 +2	97	20/40	84	−13
Numbers RE...........	20/20 −3	97	20/30	92	−5
LE...........	20/30 −2	90	20/70 +1	66	−24
CASE 109	$-4.75 = 20/20 -1$		plano $= 20/20$		
Letters RE...........	10/200	3	10/100	20	+17
LE...........	20/15 −2	100	20/15 −4	100	+ −
Landolt RE...........	6/125	4	10/125	13	+9
LE...........	20/25 −3	92	20/30	92	+ −
E RE...........	10/200	3	10/80	29	+26
LE...........	20/15 −2	100	20/15	100	+ −
Numbers RE...........	10/200 −1	1	10/100	20	+19
LE...........	20/20 −1	99	20/20	100	+1
CASE 110	$-3.00 = 20/20$		$-3.00 = -0.25 \times 180 = 20/20$		
Letters RE...........	10/100 −1	14	20/200	20	+6
LE...........	10/100 −1	14	15/200 +1	12	−2
Landolt RE...........	12/200	8	15/200	11	+3
LE...........	10/175 −1	4	15/175	16	+12
E RE...........	10/120 −1	11	20/160	38	+27
LE...........	10/120 −1	11	15/120	29	+18
Numbers RE...........	10/70 −1	28	20/200 +1	37	+9
LE...........	7/70 −1	12	15/200 +1	12	+ −
CASE 110	**Third Test**				
Letters RE...........	15/200	11	......	..	....
LE...........	15/200	11	......	..	....
Landolt RE...........	10/200	3	......	..	....
LE...........	12/200	8	......	..	....
E RE...........	20/200	20	......	..	....
LE...........	15/200	11	......	..	....
Numbers RE...........	9/100	17	......	..	....
LE...........	10/200	3	......	..	....

CHART IX.—Continued.
Results of Visual Acuity Tests and % Evaluation of Vision.

		Before Training	Visual Acuity %	After Training	Visual Acuity %	Difference %
CASE 111		−2.25 = −0.37 ×175 = 20/15 −3				
Letters	RE..........	......	..		..	
	LE..........	15/100	33	20/100	49	+16
Landolt	RE..........	......	..	......	..	
	LE..........	15/200	11	10/125	13	+2
E	RE..........	......	..	......	..	
	LE..........	15/200	29	20/160 −1	24	−5
Numbers	RE..........	......	..	......	..	
	LE..........	15/100 −1	27	13/200	9	−18
CASE 112		−2.50 = 20/20 +3		−2.50 = 20/20 +3		
Letters	RE..........	15/100	33	20/200	20	−13
	LE..........	20/100 +1	54	20/70	64	+10
Landolt	RE..........	12/175	10	20/150	32	+22
	LE..........	20/100	49	20/175	25	−24
E	RE..........	15/120	29	20/160 +1	38	+9
	LE..........	20/80 −2	56	20/80 +1	60	+4
Numbers	RE..........	15/200	11	20/200	20	+9
	LE..........	20/70	64	20/70 −1	60	−4
CASE 121		−3.25 = −0.25 ×90 = 20/20		−4.00 = −0.75 ×180 = 20/20		
Letters	RE..........	9/200	1	15/200	11	+10
	LE..........	10/200	3	15/200	11	+8
Landolt	RE..........	8/175	2	15/200	11	+9
	LE..........	8/175	2	13/200	9	+7
E	RE..........	8/160 +1	6	15/160 −1	14	+8
	LE..........	10/160	7	15/200	11	+4
Numbers	RE..........	8/200	1	15/200	11	+10
	LE..........	10/200	3	15/200	11	+8
CASE 122		−4.00 = 20/20		−4.00 = 20/20		
Letters	RE..........	10/200	3	20/200 +1	37	+34
	LE..........	10/200	3	15/200	11	+8
Landolt	RE..........	5/150	1	12/200	8	+7
	LE..........	5/175	1	10/175	5	+4
E	RE..........	10/200	3	20/200	20	+17
	LE..........	5/200	1	10/160	7	+6
Numbers	RE..........	10/200	3	20/200 −1	14	+11
	LE..........	5/200	1	10/100 −1	14	+13
CASE 124		−1.50 = 20/20		−1.25 = −0.25 ×180 = 20/20		
Letters	RE..........	20/70	64	20/40 −1	82	+18
	LE..........	20/70	64	20/40	84	+20
Landolt	RE..........	10/175 −1	4	20/100	49	+45
	LE..........	10/175	5	20/100	49	+44
E	RE..........	20/120 −1	34	20/40 +3	89	+55
	LE..........	20/120	41	20/30 −2	90	+49
Numbers	RE..........	20/70 −1	60	20/50 −1	75	+15
	LE..........	20/70 −1	60	20/40 −1	82	+22
CASE 126		−1.25 = −0.50 ×180 = 20/20		−1.25 = −0.50 ×180 = 20/20 −1		
Letters	RE..........	20/70 −2	54	20/30	92	+38
	LE..........	20/70 −1	60	20/40 +2	87	+27
Landolt	RE..........	20/200	20	20/60	70	+50
	LE..........	15/125	27	20/85	56	+29
E	RE..........	20/80	59	20/40 +3	89	+30
	LE..........	20/80 −3	52	20/50 −2	73	+21
Numbers	RE..........	20/70 −1	60	20/40 −1	82	+22
	LE..........	20/200	20	20/70 +2	69	+49
CASE 127		−3.25 = −0.25 ×90 = 20/15		−2.25 = −0.25 ×80 = 20/15		
Letters	RE..........	20/200	20	20/50 −1	75	+55
	LE..........	20/100 −1	37	20/100	49	+12
Landolt	RE..........	10/125	13	20/125	39	+26
	LE..........	10/125 −1	10	20/100 −1	37	+27
E	RE..........	20/160	29	20/80 −2	56	+27
	LE..........	20/120	41	20/80	59	+18
Numbers	RE..........	20/100 −1	37	20/100	49	+12
	LE..........	20/100	49	20/100	49	+ −
CASE 127		Third Test				
Letters	RE..........	10/70	34	......	..	....
	LE..........	20/200	20	......	..	....
Landolt	RE..........	20/125	39	......	..	....
	LE..........	20/175	25	......	..	....
E	RE..........	20/80 −2	50	......	..	....
	LE..........	20/120	41	......	..	....
Numbers	RE..........	20/200	20	......	..	....
	LE..........	20/100 −1	37	......	..	....
CASE 131		−2.00 = −0.25 ×180 = 20/15		−1.50 = −0.50 ×90 = 20/15		
Letters	RE..........	20/200	20	20/100 −1	37	+17
	LE..........	20/200	20	20/200	20	+ −
Landolt	RE..........	20/200	20	15/200	11	−9
	LE..........	20/175 −1	23	15/200	11	−12
E	RE..........	20/200	20	20/120	41	+21
	LE..........	20/160	29	20/80	59	+30
Numbers	RE..........	20/200	20	20/200 −1	14	−6
	LE..........	20/200	20	20/100 −1	37	+17

visual acuity of 3, and is theoretically capable of a 97-point increase in the percentage visual acuity, whereas one with a low-grade myopia whose uncorrected vision is 20/30 has a percentage visual acuity of 92 and is susceptible of an improvement of only 8 points in the percentage visual acuity. This statistical fallacy appears to be clearly reflected in the results. Thus, in groups I and II, where the greatest improvement in the percentage visual acuity was noted, the myopia was most severe, the initial average visual acuity of both eyes being 27.3 and 23.2, respectively, in the two groups. In group III, where there was no essential change, the myopia was less severe, the average percentage visual acuity being 40. In group IV, where there was an actual, although not significant, loss in the percentage visual acuity, the average myopia was of low degree and the average percentage visual acuity before exercises was 75.1. In short, the lower the initial percentage visual acuity, the more room there was for improvement, and the more likely improvement would result from any educational process. The higher initial percentage visual acuity, the less room there was for improvement and the less chance there would be for an educational procedure to produce improvement.

The first two points, the variation in visual acuity of myopic individuals with the same refractive error, and the swing in the same individual on different charts, in themselves disclose a margin of error in subjective testing sufficient to account for the average improvement observed in groups I and II. The third point, the weighting of the scales in favor of an improvement in those with high myopia, may also be a factor in the improvements shown by the patients in these two groups.

However, the fact remains that approximately 60 percent of the patients did show moderate to slight improvement in the percentage visual acuity after the visual training. The essential question is whether this low-grade improvement (groups I and II) and the occasional more spectacular individual improvement (cases 3 and 4) are to be explained entirely on the basis of individual fluctuations and a statistical presentation or is any credit to be given to the visual training to which the patients were subjected?

I have already pointed out that the average degree of improvement noted in groups I and II was within the limit of error of subjective testing and the individual interpretation of a blurred myopic visual image. However, it was the general impression of the examining physicians that after the eye exercises a great number of the patients were more careful in the interpretation of their visual impressions. Just how far careful study of a blurred visual image will result in an improvement in the subjective visual acuity can readily be demonstrated on any aphakic individual of ordinary intelligence. In an aphakic individual with 20/15 corrected vision in each eye, the introduction of +1.00 spheres before his correction will immediately reduce the visual acuity to about 20/40. However, with a few minutes' careful study of an unknown letter chart or a broken-circle chart, such an individual will be able to decipher the 20/20 line accurately. Similarly, the introduction of +2.00 spheres, giving a false myopia of −2.00 diopters, reduces vision to 20/100, but after a few minutes' study the patient can identify symbols on the 20/50 line. In short, the subjective determination of the vision of a myopic person on the Snellen chart is, within certain limits, a test of the individual's ability to interpret correctly the blurred visual impression received on the retina. In so far as any form of visual education aids an individual to the maximum utilization and correct interpretation

of a blurred retinal image, such procedures are of value. There are obviously definite limits within which such education is possible. For example, this visual-training program appears to be of little value to individuals unable to pass the visual requirements of the United States Naval Academy. There were nine such individuals in this group of trainees and only in one instance (4) was the improvement sufficient to allow the candidate to pass the Naval Academy examinations, although in one other case (3) the candidate came close to the passing level. However, the more the initial interpretation of a visual sensation is faulty, the more unstable or careless the individual is in his visual habits, the more room and hope there is for an improvement as a result of education.

The different examining physicians were impressed by a psychologic improvement in a number of patients. Some patients while exhibiting no material change in their visual acuity, were nevertheless convinced they saw better and that they used their eyes with greater satisfaction to themselves. There were no psychiatric examinations on these patients, but the examining physicians all agreed that this psychologic improvement was more noticeable in those individuals who appeared somewhat emotionally unstable. It should therefore be conceded that the visual training, in so far as it produced a psychologic change in the patients toward their visual handicap, was of benefit to the patients.

Therefore, while it is admitted that within narrow limits there may be some educational merit to this visual training, and that in impressionable individuals there may be some beneficial psychologic change, the results of this study give little comfort to the advocates of this method of treating myopia. The visual gains resulting from this training were small and not constantly maintained. The visual training had no effect on the basic myopia as determined by retinoscopy. The results of this experiment indicate that the visual training is of no value in curing myopia.

Summary and Conclusions

A series of 103 myopic individuals were selected from a total of 130 applicants. The uncorrected visual acuity of these patients was recorded, a cycloplegic instilled, and the retinoscopic and static refractions determined. These 103 myopic persons were then returned to a group of optometrists and psychologists for a course of visual training designed to improve their uncorrected vision. At the end of this visual training the patients were again examined to determine what change had occurred in their uncorrected vision. It was found that 30 of these patients, or 29 percent, showed a low-grade improvement on all charts. This improvement averaged an increase of 27 points in the percentage visual acuity. A second group of 31 patients, or 30 percent, did not show a consistent improvement on all four charts but did show an overall improvement in both eyes which averaged 14.7 points increase in the percentage visual acuity. As far as could be determined the improvement in these two groups was not consistently maintained. A third group of 32 patients, or 31 percent, showed practically no change in the percentage visual acuity. A fourth group of 10 patients, or 9 percent, showed a decrease in the percentage visual acuity of 10.8 points.

The changes in the percentage visual acuity noted was found to lie within the limits of error of subjective testing of the visual acuity. Also the estimating of change on the basis of percentage visual acuity weights the scales in favor of improvement in those who have high myopia.

The maximum average increase noted in group I was between one and three lines improvement in the Snellen scale. It was believed by the examiners that education in the correct interpretation of a blurred visual image was the chief factor in the improvement noted in this group. It was further believed that the exercises produced a beneficial psychologic reaction in certain patients toward their visual handicap, regardless of whether an actual improvement in visual acuity had occurred.

With the possible exceptions of educating some patients to interpret blurred retinal images more carefully and of convincing some others that they could see better even though there was no actual improvement, this study indicates that the visual training used on these patients was of no value for the treatment of myopia.

EYE CONDITIONS AMONG CHILDREN OF PREMATURE, FULL-TERM, AND HYPERMATURE BIRTH*

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The frequent appearance of amblyopic school children whose history records premature birth suggested the possibility that such children's vision might mature more slowly than that of others. A preliminary study[1] of 100 poor readers revealed a markedly higher incidence of premature births than is usually encountered in the general population. Furthermore, 31 percent of the children born prematurely were found to have defective vision.

Since then 619 children have been studied, of whom 155 were born before the completion of the normal term of pregnancy or weighed $5\frac{1}{2}$ pounds or less at birth.† They were compared with 439 children who were born at full term or whose birth weight was more than $5\frac{1}{2}$ pounds. Both of these groups were compared with another composed of 25 children born during or after the tenth calendar month of pregnancy. The age range in all groups was from 5 through 17 years. The writer's primary interest in the subject centered on the educational implications for children from first through twelfth grade and only those whose ages corresponded to this range were admitted to the study.

All of the children were given complete eye examination, and measurements of visual acuity, refraction, and muscular imbalance were taken. The visual-acuity and muscular-imbalance measurements were made with the refractive correction in use. In addition other physical defects and diseases observed during eye examination were recorded.

Comparison of the groups without reference to age revealed 28 percent *more* children with vision of 20/30 or less among those born prematurely. The frequency difference was the same for each eye but for both eyes together the difference was 24 percent. The same group presented 4 percent *less* hypermetropia in the right eye and 12 percent *less* in the left eye, but displayed 9 percent *more* myopia in the right eye and 8 percent *more* in the left eye. The groups showed little or no difference in the incidence of either hypermetropic or myopic astigmatism. They also displayed no difference in the

incidence of either esophoria or exophoria of five prism diopters or more in distance vision but exhibited 4 percent *less* esophoria and 1 percent *less* exophoria in near vision.‡

The central tendency of the examination results were studied in terms of median.§ The premature group exhibited a median visual acuity (with correction) of one Snellen line *poorer* vision in the left eye only. No other important differences in the medians were noted in any of the fields of investigation.

All of the cases of both premature and full-term birth were next distributed according to age. This necessarily provided smaller numbers of cases at each age level and limited the study to that extent. However, age comparisons have shown interesting trends which are worth considering.

The frequency of vision of 20/30 or less was found to be higher in the premature group at *all* ages, for each and for both eyes together. There was a *higher* incidence of low vision in the left eye among the premature cases at the 6-, 7-, and 12-year levels, and at the 6-, 7-, 9-, 10-, 11-, 14-, and 16-year levels among the full term cases. The premature group exhibited a *higher* frequency of low vision in the right eye at 17 years. It appears that there is a general tendency toward more frequent low vision in the left eye in both groups, but this tendency was greater among those who were not premature. With age, both groups dis-

played some tendency toward a decrease in the frequency of hypermetropia and an increase in that of myopia in both spherical and astigmatic refraction. The premature group presented a general tendency toward a *lower* frequency of hypermetropic astigmatism in each eye at the ages from five through eight years. The frequency of exophoria in distance vision, among the premature cases, was *lower* until the age of nine years. From 10 to 13 it showed less difference from that of the full-term group, but at the age of 14 it rose sharply above their level and tended to remain elevated through age 17. The frequency of exophoria in near vision tended to increase with age in both groups after the eighth year. The premature children exhibited a tendency toward a greater incidence than did the others. No marked difference between the frequencies of esophoria in distance vision was noted, but the premature group showed a consistently *lower* frequency of esophoria in near vision.

The study of central tendency by age levels revealed a consistently *lower* median visual acuity through the ninth year in the premature group and a median visual acuity of one Snellen line *poorer* vision in the left eye in each group at the sixth year. The median myopia tended slightly to show an *increase* from the fifteenth through the seventeenth year among those prematurely born. Measurements of muscular imbalances were distributed on either side of the zero or orthophoric point, with exophoria on one side and esophoria on the other. This was done so as to take into account all the cases instead of studying exophoric and esophoric cases separately without regard to the cases of orthophoria. This seemed wise since measurements of muscular imbalances are commonly taken in degrees or prism diopters of deviation from the orthophoric or mid point on the whole

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‡ Muscular-imbalance measurements for distance vision were taken at 20 feet. For near vision the test distance was determined by the body build of the child, the reading or near distance being such that the arm formed a right angle with the forearm while the book was being held.

§ The median is the position in a distribution where the middle case falls. It is superior to the arithmetic mean (average) because one or two abnormally high or low scores do not distort the expression of central tendency. For this reason a truer indication is provided.

scale from exophoria through orthophoria to esophoria or vice versa.

The medians in the two groups differed little in tests at 20 feet, both falling either in the orthophoric range or in one of the low exophoric intervals. No esophoric medians appeared in either group in distance or in near vision. The medians for near vision were in the orthophoric range difference being in feeblemindedness, which occurred 3 percent *more* frequently among the children born prematurely. They also exhibited a little less than 2 percent *more* nerve diseases and dysfunctions as a group and speech defects than did those born at full term. No instance of vertical muscular imbalance occurred in either group, a finding which tends

TABLE 1

COMPARISON OF THE EYE CONDITIONS OF CHILDREN OF PREMATURE AND FULL-TERM BIRTH

| | | Frequencies—Total Groups | | | | | Medians—Total Groups | | |
		Full Term	Premature	Difference			Full Term	Premature	Difference
No. Cases:		439 percent	155 percent	percent					
Visual Acuity 20/30 or less	O.D.	20	48	+28	Visual Acuity	O.D.	20	20	0
	O.S.	23	51	+28		O.S.	20	30	1 Snellen line. poorer
	O.U.	18	42	+24		O.U.	20	20	0
		Hyp. Myo. percent	Hyp. Myo. percent	Hyp. Myo. percent					
Refraction 1.00D. of Hyp. or more. 0.50D. of Myopia or more Astig. Spher.	O.D.	19 14	15 23	−4 +9	Refraction Astigmatic Spherical	O.D.	+.12D.	0	−.12D.
	O.S.	24 15	12 23	−12 +8		O.S.	+.12D.	0	−.12D.
	O.D.	5 5	6 6	+1 +1		O.D.	+.50D.	+.37D.	−.12D.
	O.S.	4 7	3 6	−1 −1		O.S.	+.50D.	+.50D.	0
		Exoph. Esoph. percent	Exoph. Esoph. percent	Exoph. Esoph. percent					
Muscular Imbalance 5 P.D. or more Near Dist.		2 2	2 2	0 0	Muscular Imbalance	Dist.	0	0	0
		21 6	20 2	−1 −4		Near	0	1 P.D. Exoph.	+1 P.D.

Note: Read plus as—The Premature group presented more than. Read minus as less.

in both groups from five through seven years. Exophoria in near vision appeared first among the premature individuals at eight years and one year later among those born at full term. Although the premature group exhibited some tendency to manifest a *larger* median exophoria as age advanced, the full-term group showed little or no tendency to do so.

Other conditions noted during eye examination are presented in table 3. The frequency differences between the two groups were not marked, the greatest to confirm the very low incidence of this type of defect among the school children whose eye defects have been studied previously by the author.

The tendency toward more frequent and sometimes greater degrees of defectiveness among those prematurely born raised the question as to whether children born after an abnormally long pregnancy might show defects and deficiencies. Accordingly the full-term and premature groups were compared with another composed of children born during or after

TABLE 2
COMPARISON OF THE EYE CONDITIONS OF CHILDREN OF PREMATURE (IN ITALICS) AND FULL-TERM BIRTH BY AGES

				FREQUENCY BY AGES (PERCENT)										
Age (years)				5		6		7		8		9		10
No. of Cases				19	*5*	37	*16*	50	*12*	45	*18*	52	*15*	54 *14*
Visual Acuity 20/30 or poorer.	O.D.			53	*80*	43	*63*	32	*54*	26	*50*	21	*53*	13 *36*
	O.S.			53	*80*	53	*81*	38	*62*	26	*50*	31	*53*	16 *36*
	O.U.			53	*80*	43	*56*	34	*46*	23	*50*	21	*47*	13 *29*
Refraction 1.00D. Hyp. or more 0.50D. Myopia or more	Spherical	O.D.	Hyp.	38	*0*	20	*14*	17	*17*	22	*7*	24	*16*	23 *0*
			Myo.	4	*0*	3	*7*	6	*8*	8	*29*	4	*0*	11 *25*
		O.S.	Hyp.	38	*0*	16	*14*	17	*17*	24	*7*	26	*8*	26 *0*
			Myo.	4	*20*	3	*14*	6	*8*	8	*29*	4	*0*	9 *14*
	Astig.	O.D.	Hyp.	13	*0*	6	*0*	3	*0*	0	*0*		*8*	4 *0*
			Myo.	0	*0*	0	*0*	2	*0*	0	*0*	2	*0*	4 *8*
		O.S.	Hyp.	13	*0*	10	*0*	3	*0*	3	*7*	4	*8*	4 *0*
			Myo.	0	*0*	0	*20*	8	*0*	0	*0*	2	*0*	4 *8*
Muscular Imbalance 5 P.D. or more.	Esoph.	Dist.		0	*0*	13	*0*	3	*0*	3	*0*	2	*0*	18 *8*
		Near		0	*0*	30	*19*	17	*0*	16	*22*	13	*33*	4 *31*
	Exoph.	Dist.		0	*20*	0	*0*	7	*0*	0	*0*	7	*0*	22 *8*
		Near		0	*20*	3	*0*	9	*0*	9	*0*	9	*8*	7 *0*

		MEDIANS BY AGES												
Visual Acuity (Snellen)	O.D.			20	*40*	20	*30*	20	*30*	20	*30*	20	*30*	20 *20*
	O.S.			20	*40*	30	*40*	20	*30*	20	*30*	20	*30*	20 *20*
	O.U.			20	*40*	20	*30*	20	*30*	20	*30*	20	*30*	20 *20*
Refraction	Sph.	O.D.		0	*0*	0	*0*	0	*+.50*	0	*0*	0	*+.75*	0 *0*
		O.S.		0	*0*	0	*0*	0	*+.50*	0	*0*	0	*+.50*	0 *0*
	Ast.	O.D.		+.75	*—*	+.75	*−.50*	+.50	*+.50*	+.50	*+.50*	+.50	*+.50*	+.50 *−.25*
		O.S.		+.75	*—*	+.75	*−.75*	+.50	*+.50*	+.50	*+.50*	+.50	*+.50*	+.50 *−.25*
Musc. Imbal. (Prism Diopters)	Dist.			0	*0*	0	*0*	0	*0*	0	*0*	0	*0*	0 *1 Ex*
	Near			0	*0*	0	*0*	0	*0*	0	*2 Ex**	2 Ex	*2 Ex*	0 *3 Ex*

* Ex = Exophoria.

the tenth calendar month. The small number of cases permitted only a consideration of the total group. These children, termed the Hypermature Group, presented consistently higher frequencies of low vision, hypermetropia, and exophoria, and *lower* frequencies of myopia and esophoria than did the full-term group. They also exhibited consistently *higher* incidences of hypermetropia and exophoria, and *lower* frequencies of low vision, myopia, and esophoria than did the premature group.

It was noted that the frequency of low vision in the left eye was *higher* than that of the right eye in this group as well as in the others. Whether this general tendency results from the predominance of

FREQUENCY OF AGES (PERCENT)

11		12		13		14		15		16		17	
35	*13*	32	*12*	23	*7*	31	*10*	25	*10*	22	*10*	14	*10*
16	*46*	13	*45*	13	*14*	6	*40*	12	*40*	14	*40*	21	*40*
19	*46*	13	*55*	13	*14*	11	*40*	12	*40*	18	*40*	21	*30*
9	*46*	9	*36*	7	*14*	6	*40*	12	*40*	14	*40*	21	*30*
28	*8*	27	*45*	8	*33*	7	*10*	9	*10*	18	*10*	23	*0*
13	*25*	12	*0*	24	*17*	12	*20*	34	*50*	24	*50*	31	*50*
28	*8*	27	*45*	16	*33*	24	*0*	9	*10*	18	*10*	23	*0*
13	*25*	32	*0*	28	*17*	16	*20*	39	*50*	18	*50*	31	*50*
3	*8*	0	*0*	8	*0*	0	*10*	0	*0*	6	*0*	0	*0*
7	*0*	4	*0*	0	*17*	8	*20*	17	*20*	6	*20*	0	*30*
8	*8*	0	*9*	8	*0*	0	*0*		*0*	6	*0*	0	*0*
7	*0*	7	*0*	0	*17*	11	*20*	12	*20*	12	*20*	8	*30*
3	*0*	4	*9*	0	*0*	7	*0*	5	*10*	11	*10*	0	*0*
16	*11*	21	*27*	24	*16*	20	*30*	13	*20*	29	*30*	23	*50*
3	*0*	0	*0*	0	*0*	3	*0*	0	*0*	0	*0*	8	*0*
3	*0*	4	*0*	0	*0*	6	*0*	4	*0*	0	*0*	8	*0*

MEDIANS BY AGES

11		12		13		14		15		16		17	
20	*20*	20	*20*	20	*20*	20	*20*	20	*20*	20	*20*	20	*20*
20	*20*	20	*20*	20	*20*	20	*20*	20	*20*	20	*20*	20	*20*
20	*20*	20	*20*	20	*20*	20	*20*	20	*20*	20	*20*	20	*20*
+.25	*0*	+.50	*+.75*	0	*0*	0	*0*	0	*−.25*	+.25	*−.25*	0	*−1.00*
+.25	*0*	0	*+.75*	0	*0*	0	*0*	0	*−.25*	0	*−.25*	0	*−1.00*
+.50	*+.50*	+.50	*—*	+.50	*+.50*	−.25	*+.50*	−.50	*−.50*	0	*−.50*	−.50	*—*
+.50	*+.50*	+.50	*+2.00*	+.50	*+.50*	−.25	*+.25*	−.50	*−.50*	0	*−.50*	−.50	*+.50*
0	*0*	0	*0*	0	*0*	0	*0*	0	*2 Ex*	0	*2 Ex*	0	*1 Ex*
1 Ex	*0*	1 Ex	*2 Ex*	1 Ex	*4 Ex*	0	*0*	0	*3 Ex*	2 Ex	*3 Ex*	1 Ex	*4 Ex*

right eyedness or from some other cause or causes is a matter for later investigation.

There was no difference in any of the visual-acuity medians in any of the three total groups, but the hypermature group presented a *greater* median spherical hypermetropia than did either of the other groups and the same median muscular imbalance as the premature group. It appears, then, that the hypermature cases tend to present a frequency of low vision midway between the full-term and premature groups; a higher incidence of hypermetropia and exophoria than either of the others, and muscular imbalance at near which is about as great as that in the premature cases but more frequent

TABLE 3

COMPARISON OF THE EYE CONDITIONS OF CHIL-
DREN OF PREMATURE AND FULL-TERM BIRTH

OTHER DEFECTS AND DISEASE NOTED
DURING EYE EXAMINATION

Condition	Frequencies Percent		
	Full-Term Group	Pre-mature Group	Dif-fer-ence
Accommodative insufficiency	0.7	1.3	0.6
Accommodative spasm (marked)	0.7	0	0.7
Convergence insufficiency	0.2	0.6	0.4
Strabismus—Convergent	1.5	1.7	0.2
Divergent	0.9	1.3	0.4
Ophthalmoplegia	0	1.3	1.3
Poor ocular-muscle control	0	1.3	1.3
Defects of binocular vision	3.0	4.0	1.0
Nyctalopia	1.1	1.3	0.2
Congenital cataract	0.5	0.6	0.1
Pallor of temporal side of discs	0	0.6	0.6
Hard of hearing	0.7	0	0.7
Nose obstructed	0.5	0	0.5
Speech defect	0	1.9	1.9
Psychoneurosis	1.1	0	1.1
Nerve disease or dysfunction	1.3	3.2	1.9
Feeble minded	0.2	3.2	3.0

than in either the full-term or premature groups. The complete data are presented in table 4.

The outstanding facts disclosed by the present study are the *higher* frequency of poor vision among children of premature birth at all of the ages from 5 through 17 years, and the *poorer* median visual acuity of the same group through the ninth year. While this is true of the cases involved in this particular investigation it suggests the probability that many prematurely born children enter school before being ready visually to compete with normally seeing children and go through at least four or five school years before attaining 20/20 vision. Other conditions tending to occur more frequently or to a greater degree among those born prematurely emphasize the less rapid development of this group. These findings do not support the gener-

TABLE 4

COMPARISON OF PREMATURE AND FULL-TERM GROUPS WITH A HYPERMATURE-BIRTH GROUP

		Frequencies—Total Group					Medians—Total Group		
		Hypermature	Difference from				Hypermature	Difference from	
			Full Term	Premature				Full Term	Premature
No. of Cases		25							
Visual Acuity 20/30 or less		percent	percent	percent		Visual Acuity			
	O.D.	24	+4	−24			O.D.	20	0	0
	O.S.	36	+13	−15			O.S.	20	0	0
	O.U.	24	+6	−18			O.U.	20	0	0
Refraction 1.00D. of Hyp. or more of Myopia or more Spher. 0.50D. Astig.		Hyp. Myo. percent	Hyp. Myo. percent	Hyp. Myo. percent		Refraction Spherical			
	O.D.	40 4	+21 −10	+25 −19			O.D.	+1.00D.	+.85D.	+1.00D
	O.S.	36 4	+12 −11	+24 −19			O.S.	+1.00D.	+.85D.	+1.00D.
	O.D.	12 0	+7 −5	+6 −6		Refraction Astigmatic	O.D.	+ .50D.	0	+.12D.
	O.S.	16 0	+12 −7	+13 −6			O.S.	+.50D.	0	0
Muscular Imbalance 5 P.D. or more Near Distance		Exoph. Esoph. percent	Exoph. Esoph. percent	Exoph. Esoph. percent		Muscular Imbalance			
		5 0	+3 −2	+3 −2			Dist.	0	0	0
		30 0	+11 −6	+10 −2			Near	1 P.D. Exoph.	+1 P.D.	0

Note: In difference columns read plus as more; minus as less. Read −4 percent as: The hypermature group presented 4 percent less.

ally held belief that the ill effects of prematurity are overcome quite early in life and are of no particular importance thereafter. Apparently, there is a tendency for visual handicaps to persist into the middle grades. It is also notable that a small group of children of hypermature or late birth presented defects and deficiencies which led one to think that hypermaturity may prove to be somewhat similar to prematurity as an initial handicap.

SUMMARY

One hundred fifty-five children who were born before completion of the normal term of pregnancy or who weighed 5½ pounds or less at birth are compared with 439 children born at full term or with a birth weight of more than 5½ pounds. These two groups are compared with a smaller group of children born during or later than the tenth calendar month. The outstanding tendencies noted are the higher frequency of low vision at all of the ages studied among those born prematurely and the poorer median visual acuity through the ninth year in the same group. The presence of somewhat comparable defects and deficiencies in both the premature and hypermature groups provides a suggestion that hypermaturity may prove to be of similar but probably less importance than is prematurity as an initial handicap.

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REFERENCE

[1] Eames, T. H. Comparison of children of premature and full term birth who fail in reading. Jour. Educ. Research, 1945, v. 38, March, pp. 506-508.

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In a report of the Committee on Industrial Ophthalmology of the Section on Ophthalmology of the American Medical Association, read before the fourth annual Congress on Industrial Health in Chicago, January 13, 1942, the scope of industrial ophthalmology was divided into five interrelated parts, as follows:

1. The efficient use of vision in industry.
2. Eye accidents—their prevention and the treatment of injuries.
3. Conservation of visual health.

4. Visual economics—the effect of vision on earning ability and on production.
5. Medicolegal ophthalmology.

The report goes on to state that the most neglected field of industrial ophthalmology relates to efficient visual performance (items one and four, above), and that the study of visual effectiveness includes the following topics:

1. Basic elements of visual performance—the need of standards for essential functions of vision for specific jobs.
2. Methods and techniques of testing.
3. Ways and means of correcting visual defects.

4. Placement of employees according to visual qualifications.
5. Health factors that influence vision.
6. Programs of coöperation between management, employees, industrial medical departments, and ophthalmologists in establishing practical methods of visual testing, correction, and placement.

In studies of the first four of these topics, the chief interest has lain in the individual visual differences of people; for people differ—by nature, training, education, and inclination.

The economic significance of these individual differences is appreciated by management, because a misplaced employee brings about many complications. Management knows that the outputs of identical machines, manned by different operators, are seldom the same. Some operators may be trying to work beyond their capacity. Some are poor producers, some good, some superior. Some have many accidents, some few, some none. Too, recent legislation has made difficult the promiscuous hiring and firing that was easily possible a dozen years ago, and employers today have a higher sense of social obligation. Hence, the consideration of individual differences in the selection of applicants for placement on any job is becoming more and more important.

There have been numerous excellent studies in this field both in this country and in England.[1,2,3] The work of the past five years has been largely in the realm of testing methods and in the actuarial approach to the factual interpretation of visual problems in industry. In applying the facts disclosed by such study, industry is uncovering many employees who must be referred for professional attention. It is, therefore, imperative that ophthalmologists know about this fact-finding program and the varied visual needs of industry.

The mention of visual needs of industry probably immediately conjures up in the reader's mind a picture of the norms with which he deals daily, in terms of 20/20 Snellen acuity at distance, orthophoria at far, six prism diopters exophoria at near, and so forth. No such inflexible standard of perfection applies in industry any more than does a standard of physical fitness which would require each person to have a head size of exactly 6⅞. Whether in industry, or elsewhere, according to Snell,[4] "Good vision is that degree of visual functional ability which is adequate to perform the visual task presented." This definition should be kept in the forefront, for it removes the rigid standards of previous thinking and substitutes the standard that fits each case. It eliminates the idea of one standard of perfection—good distance acuity on the Snellen chart—which has led personnel placement astray in its attempt to allocate employees properly to jobs.

Almost every job requires some visual skill. Some jobs require very highly developed visual skills. Certain skills must be more highly developed than others for some jobs. For example, such a skill as good distance acuity, which is necessary for the crane operator, is contraindicated for the hosiery looper or radio-tube assembler who requires good near acuity. A negative correlation has been found between distance acuity and production in looping hosiery.[5] There are, then, jobs that require certain skills and for which other skills are not required.

Researches conducted (and continuing) in various industries on thousands of employees by Professors Tiffin, Wirt, and co-workers of Purdue University, and Dr. Hedwig S. Kuhn, have shown that of all the tests that have been tried there

are 12 measures of individual differences that are most useful in correlating visual skills with performance on the job. Seven of these are distance tests and five are near tests.[6]

1. Vertical heterophoria—far
2. Lateral heterophoria—far
3. Binocular acuity—far
4. Right-eye acuity—far
5. Left-eye acuity—far
6. Color discrimination
7. Vertical heterophoria—near
8. Lateral heterophoria—near
9. Binocular acuity—near
10. Right-eye acuity—near
11. Left-eye acuity—near
12. Stereopsis

The individual differences disclosed by these tests are certainly revealing of some facts which have not been fully appreciated in the past. As an example, suppose that several milling-machine operators
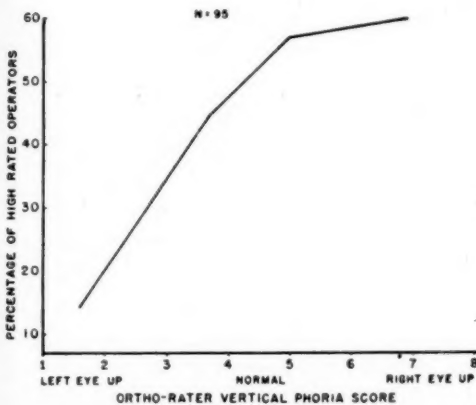
Fig. 1 (Lueck). Relation between near vertical phoria and rated success for milling-machine operators. From Tiffin and Wirt, in Jour. Consult. Psych., 1944, v. 8, pp. 80-89.

from a nearby plant present themselves for visual rehabilitation, and in the course of the examination disclose a hyperphoria of the right eye. The refractionist's tendency would be to correct it in the spectacle lenses by prescribing the necessary amount of prism, base down,

in the right lens. Yet such action might seriously disturb those men on the job, cause lower production, and increase spoilage. Facts gathered seem to indicate that a hyperphoria of the right eye can be tolerated on the job, whereas a hyperphoria of the left eye cannot be tolerated (fig. 1).

This should have been anticipated, now that we know the facts, from a close
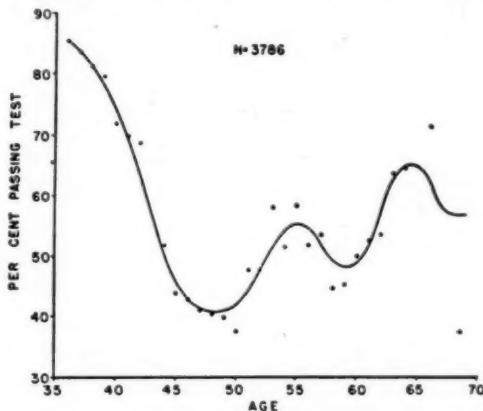
Fig. 2 (Lueck). Relation between age and visual discrimination at near. The two peaks occur at the age at which the average man obtains his first bifocals and at the age at which he obtains his second and last pair. From Tiffin,[10] "Industrial psychology," p. 150.

study of how a milling-machine operator holds his head in watching and setting the machine. Over a period of years he develops this hyperphoria as an occupational characteristic peculiar to this job, and until milling machines are redesigned to eliminate this phenomenon of "right eye up," milling-machine operators will continue to develop this tendency.

Another interesting comparison, of the many that might be drawn, is one which relates the number of persons, passing a simple near-acuity test, with age. This comparison shows graphically a fact long known to manufacturers of bifocal lenses, and one affecting the relative numbers of different segmental additions made and

stocked. People put off getting bifocals. Kuhn[7] states that patients are too often aided and encouraged in this practice by the prescribing of the "compromise" lens.
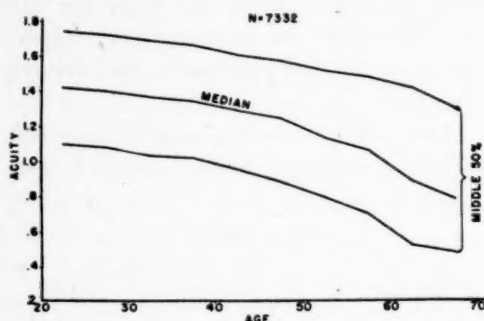
Fig. 3 (Lueck). Relation between age and distance visual acuity. From Tiffin, "Industrial psychology," p. 149.

Further, people in general make an average of two trips for professional attention after presbyopia becomes noticeable. One trip is made between the ages of 45 and 55 years, and a final trip between the ages of 60 and 65. The curve in figure 2 discloses that presbyopia is already affecting some individuals at the age of 35 years. The trend of diminishing near acuity is not arrested by increasing use of spectacles until about age 50; and even with whatever reading glasses and
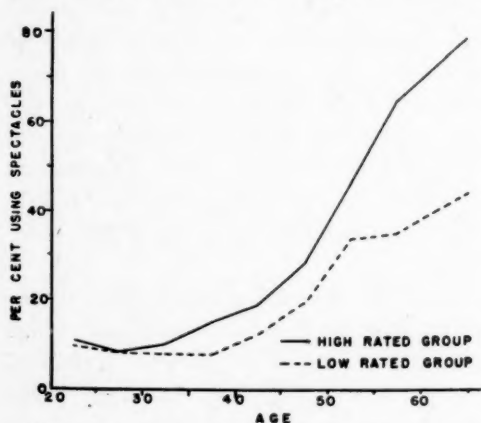
Fig. 4 (Lueck). Relation between age and use of spectacles for general wear by high-rated and low-rated employee groups. From Tiffin, "Industrial psychology," p. 145.

bifocals are procured, this loss in near acuity is never fully compensated in any typical industrial group. Obviously, there is need for more attention to patients requiring bifocals, and need for better publicization of the potentialities of multifocals. There is a need for the greater use of trifocals to raise the acuity-performance level. Trifocals are often indicated at about age 50 when the nearest point of clear vision through the distance lens is beyond the farthest point of clear vision through the near portion. The shift from bifocal to trifocal should be seriously
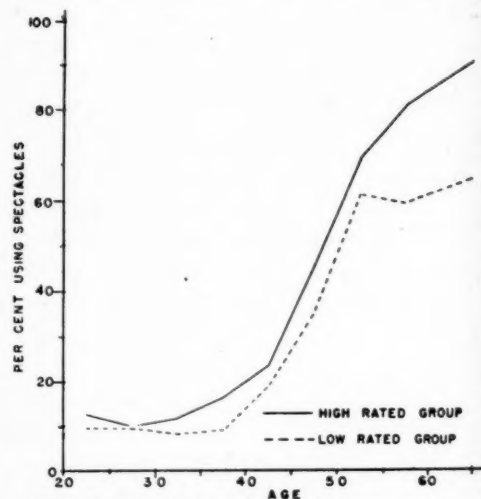
Fig. 5 (Lueck). Relation between age and use of spectacles for near vision by high-rated and low-rated employee groups. From Tiffin, "Industrial psychology," p. 146.

considered at the time of prescription of a +2.00D. sph. add.[8] Some jobs will demand a shift to trifocals before a +2.00D. sph. add is needed.

Visual skills vary with age. This is widely appreciated so far as near acuity is concerned; but investigation shows interesting trends in other functions, too. Figure 3 shows the relationship between distance acuity and age for over 7,000 employees in a steel mill. The upper and lower curves enclose the middle 50 percent of the acuity scores made at each

age. Since these curves are practically parallel it is obvious that the spread of scores changes little with age. Hence, the conclusion can be drawn that loss of acuity with age is universal. As a result, industry is beginning to recognize that a satisfactory level of employee visual acuity today may be unsatisfactory later and that employee job performance may be affected by this change with age. Likewise, industry is becoming aware of the fact that those employees who use spectacles for constant wear or for near use are, in general, better in job performance (figs. 4 and 5). Therefore, it can be expected that periodic rechecking will be encouraged among the employees.

Some jobs such as dyeing, paint mixing, color printing, wiring of electrical devices with colored insulation wire, the sorting of colored plastic products, and the like, require the skill of good color discrimination. Simple tests for the detection of color blindness are coming into use in industry; but this is not enough. What is needed is a simple means of evaluating the "color-normal" worker's capacity for hue discrimination, for this varies considerably from individual to individual quite apart from ability or inability to identify and name colors properly. Two workers may both pass color-blindness tests with perfect scores, and yet differ greatly in ability to discriminate close-together shades of red or close-together mixtures of yellow and green. And, there is evidence that this ability changes with age.[9] Methods of testing color discrimination are being studied and developed, and will eventually be made available to industry in the form of simple instruments or additions to present test-batteries.

There are many jobs that demand some degree of stereopsis for best performance. Among some that might be mentioned are truck operation, assembling, and inspec-

tion on small parts. Depth perception changes with age, too, but does not decline steadily. Rather, in most cases, this skill increases up to about age 30, remains fairly stationary until approximately age 50, then declines rapidly (fig. 6). One explanation for the increase in stereopic acuity from age 20 to 30 is that experience in work requiring perception of depth improves this function. This explanation has been advanced independently by Snell and Kuhn. Tiffin[10] concludes that this ex-
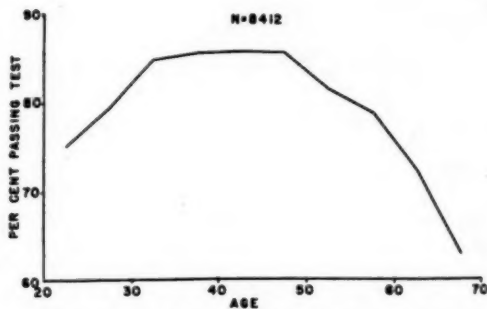
Fig. 6 (Lueck). Relation between age and stereoptic acuity. From Tiffin, "Industrial psychology," p. 152.

planation implies that an increased ability to perceive depth may be accelerated through training.

Adaptation to some jobs changes visual skills. Particularly is this true of near-point applications such as inspection and assembly operations on small parts and close-tolerance manufacturing operations. By way of comparison we might look at the distribution of near-acuity scores for groups with less than six months' experience versus groups with over six months' experience in radio-tube assembly (fig. 7). Tiffin and Wirt[5] suggest that there are at least two possible causes for this difference: Only persons with exceptionally good near acuity will stay on the job; or, acuity improves on the job. Some 26 percent of the employees in the senior group wore glasses; but 20 percent had glasses in the junior group,

which does not suggest that the higher acuity in one group was due to any greater use of professional eye care and optical aids.

Another near-point task, hosiery loop-
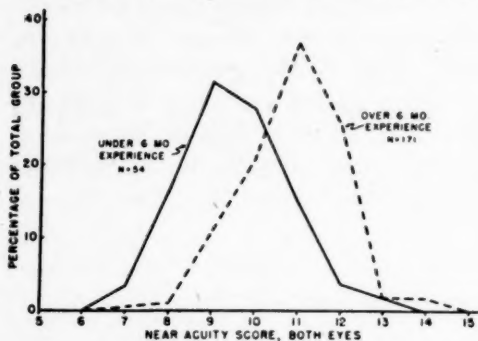
Fig. 7 (Lueck). Relation between near acuity and experience on the job for radio-tube assemblers. From Tiffin and Wirt.[5]

ing, also causes shifts in skills with tenure on the job. Figure 8 shows the relation between the number of employees passing a distance-acuity test and experience on the job. There is a very substantial downward trend in distance acuity which manifests itself whether or not glasses are worn. This might be expected as the result of continued work at the extremely close distance of 8 inches neces-
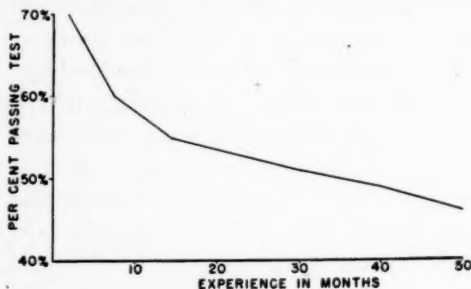
Fig. 8 (Lueck). Relation between distance visual acuity and experience on the job of hosiery looping. From Tiffin, "Industrial psychology," p. 153.

sary to obtain an enlarged image of the work so that it can be seen adequately. The actual change in focus posture was measured and is shown in figure 9. These people became "occupational myopes."

Of interest to management and the safety engineer are relationships between visual skills and accident rate. Unfortunately, the accident may not have happened to the particular employee whose poor vision was the cause, and the statistical approach to this problem is not easy, since adequate records are difficult
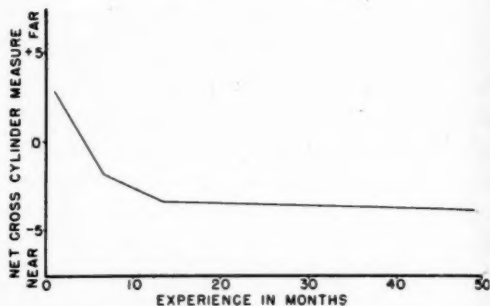
Fig. 9 (Lueck). Relation between focus posture and experience on the job of hosiery looping. From Tiffin, "Industrial psychology," p. 154.

to obtain. The breaking of a defective machine part may injure a workman through no fault of his. The blame should lie with the inspector—usually in some
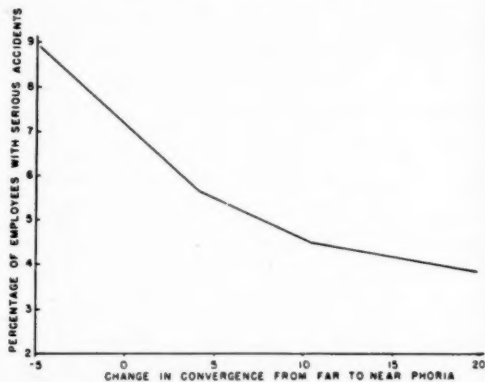
Fig. 10 (Lueck). Relation between heterophoria and serious accidents. From Tiffin and Wirt, in Jour. Consult. Psych., 1944, v. 8, pp. 80-89.

other factory—who passed the machine part. One relationship that has been found is shown in figure 10. This shows the accident rate versus the algebraic

BAUSCH AND LOMB OCCUPATIONAL VISION TESTS
WITH THE ORTHO-RATER

PLANT _____

DEPARTMENT _____

JOB _____

SCORE SUMMARY SHEET NO. _____

TESTING DATES _____ TO _____ BY _____

TABULATED DATE _____ BY _____ FILE _____

FORM 1

TEST SCORE	FAR PHORIA -Vertical	FAR PHORIA -Lateral	FAR ACUITY -Both	FAR ACUITY -Right	FAR ACUITY -Left	FAR ACUITY -Worse	DEPTH	COLOR	NEAR ACUITY -Both	NEAR ACUITY -Right	NEAR ACUITY -Left	NEAR ACUITY -Worse	NEAR PHORIA -Vertical	NEAR PHORIA -Lateral
15	(shaded)	1							1				(shaded)	10
14	(shaded)								1			1	(shaded)	4
13	(shaded)	1							7				(shaded)	5
12	(shaded)	5	10			1			33			2	(shaded)	2
11	(shaded)	4	20			8			50			11	(shaded)	4
10	(shaded)	14	40			23			44			16	(shaded)	6
9	2	13	63			47	22		24			63	3	13
8	6	27	23			42	5		6			29	1	14
7	23	30	11			21	14		2			19	7	17
6	64	31	2			7	26	14				12	10	27
5	48	16				5	15	59				5	61	22
4	15	9	1			3	18	41	2				54	17
3	6	2					11	36					19	9
2		9				1	23	17				1	10	9
1	2	5				6	19	2				2	3	8
0	(shaded)	(shaded)				6	17	1				9	(shaded)	(shaded)
X	(3)	(3)											(2)	(3)
N	167	167	170			170	170	170	170			170	168	157
Σ														
Σ²														
M	5.60	6.86	9.32			7.81	4.34	4.04	10.54			1.95	4.43	6.83
S.D.	1.23	2.57	1.33			2.51	2.87	1.22	1.48			2.54	1.36	3.60

FAR TESTS | NEAR TESTS

Fig. 11 (Lueck). Summary sheet of scores made on each of the 12 visual tests administered to 170 piston-ring inspectors. See footnote marked †. Kindly furnished by Dr. Wirt (unpublished).

sum of far and near heterophorias. From this curve we ascertain that those with the *least* change in convergence effort from distance to near show the greatest accident rate; those with the *greatest* change in convergence effort from far to near show the lowest accident rate. This observation relates directly to the changes in convergence that occur with changes in stimulus to accommodation, which, in turn, are affected by the lenses prescribed.

Another study[11] compared visual skills as found in injury-free groups with visual

piston-ring inspectors and from the application to them of the previously mentioned battery of 12 visual tests by means of the Ortho-Rater, a precision Brewster-type haploscope.

Figure 11 is a reproduction of the summary sheet of scores made by all the people in the department, on each of the 12 visual tests administered. Scores for right and left eye have been deleted to avoid the confusion of many numbers, since neither the right nor the left eye is specifically important on this job.[†] A record of the scores for the poorer eye has, how-

TABLE 1
VISUAL ACUITY IN 170 PISTON-RING INSPECTORS

Test Score:	4	5	6	7	8	9	10	11	12	13	14	15	Number	% of whole group	Mean	N_1	%
Sub-group "A" (best rated)						2	11	13	11	1	1		39	23.0	11.02	37	27.3
Sub-group "B"	1					1	16	17	14	1		1	51	30.0	10.90	49	36.0
Sub-group "C"					5	13	13	13	5	4			53	31.1	10.22	35	25.7
Sub-group "D" (poorest rated)	1			2	1	8	4	7	3	1			27	15.9	9.80	15	11.0
Total	2			2	6	24	44	50	33	7	1	1	170	100.0		136	100.0
% A & B Operators		10				13	61	60	76	44.5							
		rejectables					acceptables										

N.B.: N_1 and associated % figure, show number and percentage of operators remaining in each group after application of standard chosen.

skills as found in serious-injury groups and in groups showing high frequency of minor injuries. It was found that the injury-free group was significantly superior to the serious-injury group in acuity of the poorer eye at near. The injury-free group was also significantly superior to the high-frequency-of-minor-accident group in regard to lateral heterophoria at far and in depth perception.

Now that we have considered briefly the visual skills that have been found important in industry, some of the individual differences for various skills, their variation with age and with experience on the job, and their relation to accidents, it may be profitable to consider a specific group of workers. Let us see what statistical evidence has been developed from the ratings, on the job, of a group of 170

ever, been made. If this total group is broken up into the superior, good, fair, and poor operators according to their production or other performance rating on the job, and a summary sheet such as this is prepared for each sub-group, the arithmetical means of the scores for (say) acuity at near computed, and the means from sub-group to sub-group compared, the mean-acuity scores will show a progressive decrease from best to poorest employees (table 1). The findings of this

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† It should be pointed out here, however, that on some jobs it is important to know whether the right or left eye has the better acuity. Job layout is often such that binocular vision of the work is prevented by the hand or by some object in the line of sight of one eye. This peculiarity is disclosed by close inspection and also by the correlation of right- or left-eye vision with job performance as revealed by testing.

particular test, then, are related to performance on this job.

If, for each score, the percentage of superior and good operators is computed, a practical score limit at one or both ends of the scale is obvious. In this case, employees scoring below 10 are rarely good operators. If all the employees on this job were selected from among those who score 10 or better on binocular near acuity, the percentage of superior and good operators would be materially increased and the percentage of fair and poor operators materially decreased. The percentage change for the near-acuity visual standard adopted is also shown in table 1. The other visual skills significant on this job were likewise analyzed, of course, and a complete pattern of visual job requirements resulted. It was then possible to conclude that if every worker on this job had been able to meet these requirements, the output of the group would have been about 9 percent greater.*

The economic value of changes in this magnitude are very considerable in industry. Increases in production as small as 3 percent show a worthwhile saving on any substantial volume of production. For instance, a production increase of 3 percent on a $3,000,000 yearly business would mean a saving of $90,000.

One question that is certain to be raised relates to the employee who does not meet the visual job standards. What becomes of him? He is referred for professional attention and visual rehabilitation. We have no guarantee, however, that the rehabilitation will cause the employee to improve on the job. There may be other reasons for his failure. He may be better suited to some other work, and this will probably be disclosed in the careful consideration of his whole case. We do know that (other things being equal)

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* This information, as yet unpublished, was kindly furnished by Drs. Tiffin and Wirt.

the man has a much better chance to make good on the job if his visual skills meet the job's requirements, and he will have a poor chance to make good if his visual skills do not meet job requirements. New employees should possess at least the minimal visual skills established as needed for the job.

It should be remembered that the entire battery of industrial-vision tests and the accompanying statistical fact-finding program for employee placement are not intended to "screen out" employees, and keep them from obtaining work. Different jobs have different visual demands. There are jobs in industry even for the blind. An industrial-vision employee-placement program permits the finding and establishment of visual-skill standards that will result in assignment of the better potential producers to a specific job. Other specific jobs have other visual requirements, and the employee not meeting one set may meet another and be put to work on the job for which he is best fitted visually. Further, these standards are flexible. They can be made more stringent in periods of plentiful labor and relaxed during periods of a tight labor market, with a full knowledge of attendant production changes that will occur. An employee-placement program based on known visual abilities will prove most satisfactory to both labor and management.

Rehabilitation of employees for any specific visual task has been mentioned, as has the specific peculiarity of the hyperphoria of the right eye found in milling-machine operators. The reader may have been wondering how he could know just what visual skills are required of any factory employee who is referred to him for eye care. One thing can be asserted: the employee will not be able to say how he uses his eyes. If questioned he may say that he operates such-and-such a ma-

chine. Pressed for more information, he will tell all about what the machine does —but not what he does, or how he uses his eyes. He will not be able to estimate at all exactly the working distances— ahead, to right, left, down, and up—that are imposed upon him, nor will he be able to estimate accurately what these distances should be. It becomes the clinician's problem to figure out these facts. This can be done in either of two ways. One can visit the plant and familiarize himself with the needs of the workers on each type of machine. When it is practical, this is the better method. Or, one can arrange with the plant's medical, person- nel, or safety department to have the pertinent data furnished. This will usually be done as a matter of course as soon as the plant gets a visual fact-finding system underway.

Then, with the necessary data on the visual skills required and with the patient at hand, the problem is to try to give him comfortable working vision for the job, and yet allow him suitable vision for his life away from work. That is a problem which involves many considerations, principally in the relationships of accommodation, convergence, and visual acuity.

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REFERENCES

[1] Weston, H. C., and Adams, S.   The effect of eyestrain on the output of linkers in the hosiery industry. (British) Medical Research Council, Industrial Fatigue Research Board Report No. 40. London, H. M. Stationery Office, 1927.

[2] ——.   On the relief of eyestrain among persons performing very fine work. (British) Medical Research Council, Industrial Fatigue Research Board Report No. 49. London, H. M. Stationery Office, 1928.

[3] ——.   Further experiments on the use of special spectacles in very fine processes. (British) Medical Research Council, Industrial Fatigue Research Board Report No. 57. London, H. M. Stationery Office, 1929.

[4] Snell, A. C.   The need for a more realistic ophthalmic service in industry. New York State Jour. Med., 1942, v. 42, pp. 1435-1441.

[5] Tiffin, J., and Wirt, S. E.   Near versus distance visual acuity in relation to success on close industrial jobs. Trans. Amer. Acad. Ophth. and Otolar., 1944, Suppl. (June), pp. 9-16.

[6] Snell, A. C., Culler, A., and Kuhn, H. S.   The field of industrial ophthalmology. A report by the Committee on Industrial Ophthalmology of the Section on Ophthalmology of the American Medical Association. Jour. Amer. Med. Assoc., 1942, v. 118, pp. 610-613.

[7] Kuhn, H. S.   Industrial ophthalmology. St. Louis, C. V. Mosby Company, 1944.

[8] Lueck, I. B.   Some rules for prescribing multifocals. Bausch and Lomb Mag., 1941, v. 17, no. 4, pp. 6-7.

[9] Smith, H. C.   Age differences in color discrimination. Jour. Gen. Psychol., 1943, v. 29, pp. 191-226.

[10] Tiffin, J.   Industrial psychology. New York, Prentice-Hall, Inc., 1942.

[11] Stump, N. F.   Visual functions as related to accident-proneness. Personnel, 1944, v. 21, pp. 50-56.

A VISUAL TEST FOR INFANTS

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There are occasions in ophthalmic practice when it is desirable to demonstrate the visual efficiency of an infant. Although it is possible to make accurate eyeground studies and measurements of the refractive error and although the examiner may be able to form a general opinion satisfactory to himself, the parents are more satisfied if the ophthalmologist can actually demonstrate the child's ability to see.

The illiterate E symbol turned at different axes is often useful for this purpose in children of three years of age or older and occasionally in children somewhat younger. There is a wide gap between the newborn babe and the period when the illiterate E is useful. We are not taking full advantage of our opportunities in our study of visual response in this earliest age group. The device herein described gives ample support to this statement.

We have all seen these very small infants picking at minute specks on the coverlet and they seem particularly interested in small bugs or moving objects. In order to take advantage of this infantile curiosity, the test object as advocated for angioscotometry was quite successful in demonstrating the vision of these children. This minute white ball mounted upon a black stem is moved about against a black background. The idea of using minute dots for testing vision is, of course, not new. Grains of pollen were sometimes used in the days before Jaeger advocated type sizes.

It seemed more advantageous, however, to employ a means by which the examiner's hand would not appear in the field of the subject's vision, thereby distracting attention. To this end a small tray (six inches by six inches with a one-inch rim) with replaceable white opaque plastic bottom was devised as a background for the test. The test objects themselves at present are iron filings. These are caused to move about on the

Fig. 1

white surface by manipulating a bar magnet* on the underside of the tray so that the only object in the infant's field of observation is the minute black speck (fig. 1).

It is obviously desirable to have a series of sizes of these objects and it seemed at first difficult to devise a satisfactory method of retaining the iron filings and at the same time keeping the various sizes separated. It was finally found practical

*The new and more powerful permanent magnets are available but the permanent magneprobe magnet is ideal.

to select appropriate sizes and stick them to strips of paper by means of mucilage. Each strip bears an appropriate number indicating the size of the filing as measured with a micrometer.* When objects larger than 0.5 mm. are desirable, it is possible to use steel ball bearings which can be purchased in graduated sizes. One can then test the child with gradually increasing sized objects until its attention is attracted by the movement.

The infant is held on the mother's lap facing the examiner. A uniform illumination is caused to fall upon the tray from above and behind the subject so that no shadows may distract the child's attention. A few preliminary tests may be run and the mother may participate in order to gain the infant's full coöperation. When the child's interest has been once aroused, the mother covers one eye with her hand and the examiner then watches for the child's interest to develop. When an amblyopic eye is covered, the child's interest is maximum. When, however, the "good eye" is covered and the amblyopic eye is exposed, the child will endeavor to remove the mother's hand in order to pursue the minute speck. It is this reaction on the part of the infant which insures the dependability of the test even more than the child's unsuccessful efforts to find or follow the movements of the filings.

Should the child succeed in getting one of these specks into its mouth, the minute iron filing or even ball bearing, would not in any way injure its mouth or digestive organs.

Those cases in which the child does not respond (as with congenital cataracts, or other developmental defects) to the largest-size ball bearing, an increase in the intensity of the stimulus may be ob-

*It is, of course, not possible to secure filings of exactly uniform size.

tained by applying the ophthalmoscope stem with its mounted pinhole cap applied directly to the underside of the translucent tray bottom. A sharply defined and measurable light disc is projected through the bottom. Its intensity can be varied by adjusting the rheostat† and its size can be modified by using caps of varying-size apertures. The spot is caused to move about on the surface of the tray so that the child's attention is held and its responses noted in the same way as when the iron filings or ball bearings are used. The tray may be held vertically so that the examiner can look over its edge in order to be sure the movements of the child's eyes coincide with those of the illuminated spot.

The illustration will supply an adequate idea of the construction and application of the device.

It is, of course, obvious that in any event the test does not measure visual acuity but rather a condition of responses to brightness, contrast, and movement. Contact has been made with a number of ball-bearing manufacturers. They are unable to supply more than samples until the war is over. The smallest sample thus far supplied measures 1/64 inch in diameter. Smaller sizes are desirable—about 1/100 of an inch will probably be about right. Only one size object will be necessary, as additions of one or more follow the movements of the magnet as one.

After examining a number of hundred infants with iron filings and comparing the results of the examinations, the writer concludes that many children as young as three months old give reliable responses to the movement of the iron filings (table 1). No effort has been made to tabulate the results as it has been impossible to

† Variations of intensity are to be avoided when possible as they are not measurable and involve color change.

TABLE 1
RESPONSE TO VISUAL TEST FOR INFANTS

Age	Stimulus	Nature of response	Responding percentage	Assumption	Remarks	Authority
Term*	Intrusive reflex	Aimless wandering	100		Movements not greater than 35°. Horizontal only.† Not continuous.† No family history of squint	A
First 10 mins.	Flashlight	Lid reflex	100	Retina functioning	Pupils react. About 1 per 1000 have brown iris irrespective of color or race	B B
During first 10 days	Flashlight	Transient convergence reflex	9	Macula begins to function	Same as above	B
5–6 weeks	Flashlight or massive objects	Follows movements with eyes for few seconds	100 ?	Developing macula function and muscle coordination	Approach of nurse or mother more frequently noted	A
6–8 weeks	Smaller objects	Follows movements for few seconds	100 ?	Same as above		A
3–4 mos.	1″ black cube against white surface at 2′	Follows movements for 1/2 minute	100 ?	Visual acuity 6/728.00	Head moves. Also inspects own hands. †Crude as an actual measurement	A
6 mos.	1/3″ black cube against white surface at 2′	Follows movements through full angle of eye movements	100 ?	Visual acuity about 6/288.00	†Method of testing can be improved. Has perceived red and yellow for about three months	A and C
9 mos. to 1 yr.	Black cubes on white	Follows with eyes. Hands and body in prolonged attention.	100 ?	Development and coordination of all eye functions. Visual acuity about 6/72		A
2 yrs.	E chart	Indicating position of letter	100 ?‡ 6/12			A
3 yrs.	E chart	Indicating position of letter	100 ?‡ 6/12			A
4 yrs.	E chart	Indicating position of letter	100 ? 6/9			A
yrs.	E chart	Indicating position of letter	100 ? 6/6			A
yrs.	Snellen	Reads	100 ? 6/6		From this point on less liable to develop strabismus	A

* It has been pointed out that if a powerful light be flashed on the abdominal wall of a pregnant woman shortly before term, fetal movements will become more active. This may not be an ocular response at all. The writer does not believe that this is 100 per cent, however.
† Inserted by J.N.E.
‡ In my experience only 50 percent of children two years of age will respond.
? Percentage questioned by the writer.
Authority:
  A Chavasse, F. B.   Worth's squint or the binocular reflexes and the treatment of strabismus. Ed. 7, Philadelphia, P. Blakiston's Son & Co., Inc., 1939, p. 90 ff.
  B Bull. Neur. Inst. New York, 1932, v. 2, March, p. 12.
  C Duke-Elder, W. S.   Textbook of ophthalmology. Henry Kimpton, 1932, v. 1, p. 886.
  Also National Society Prevention of Blindness, Pub. 66, p. 18. Public Health Bulletin 182, U.S. Government.

secure the necessary minute ball bearings to use if the test is to have quantitative value.

A partial survey of the literature permits the tabulation of certain norms of judging visual responses in infants. It will be noted that some of the methods are very crude.

The test tray and method herein presented allow a study of the child's responses nearly from birth until he is able to read the usual illiterate "E" charts.

23 Schermerhorn Street (2)

REPEATABILITY OF KERATOMETRIC READINGS*

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Introduction

The reliability of the various measurements made in the determination of ocular anomalies is a question that arises occasionally. Opportunities for determining the accuracy or repeatability of ophthalmic instrumentation are infrequent. The time and cost to the patient and to the examiner are factors that often outweigh the other values of studies of this kind. Nevertheless, it is important that the reliability of the instruments and techniques used be known. The final result of any examination will be influenced by the reliability of the instruments and techniques used; this in turn necessarily depends on the stability of the conditions being measured and on the possible variations in measurement due to the interpretation of the examiner.

With respect to the keratometer two of these factors—namely, the reliability of the instrument and the effect of the examiner's interpretation—are determined in this study.

The stability of corneal curvatures in nonpathologic cases is generally accepted. The role which ophthalmometry should play in the determination of the total ametropia has been discussed innumerable times and need not be considered here. In the presentation of the data, however, the subjective refractive corrections are included for the interest that they may have for some readers.

Few studies dealing with the repeatability of ophthalmic instrumentation can be found in the literature. For example,

the repeatability of the ophthalmo-eikonometer measurements was reported[1] in 1940. This study included also the repeatability of the refractive error as determined by the method of stigmatoscopy.

The nature and statistical frequency of astigmatic errors have been recently studied in the prescriptions given to 2,000 consecutive patients at the Dartmouth Eye Institute. Astigmatic corrections below 0.25D. cyl. were not considered. The results of the study are given in the following table:

TABLE 1
Distribution of Astigmatic Errors

Type of Astigmatism	Number of Patients	Percentage
With the rule	631	31
Against the rule	412	21
Oblique (axis 20° off the horizontal or vertical)	562	28
With the rule in one eye and against the rule in the other eye	57	3
No astigmatism or astigmatism below 0.25D.	338	17
Total	2000	100

From this table it is seen that 83 percent of the patients had astigmatic errors of 0.25D. cyl. or more, whereas the astigmatism of the remaining patients was considered insignificant.

It is obvious from the high prevalence of astigmatic errors in routine refractive cases that all refractionists should be aware of the reliability of the instruments and methods used to detect astigmatism. Since the cornea constitutes four fifths of the total refracting power of the eye, the measurement of the curvature of this surface determines the main seat of as-

76

tigmatism. Aside from regular refractive cases it is helpful in cataract surgery to know the corneal curvatures before and after the operation. The surgeon may be guided in the type of operation when he has found by keratometric readings that certain techniques result in more post-operative astigmatism than do others. The use of the keratometer in aniseikonic examinations enables one to calculate [2,3] the expected meridional image-size difference and, in the case of oblique astigmatism, the declination error. In contact-lens fitting, in cases of amblyopia, in cases of suspected malingering, and in cases of corneal pathologic change the keratometric measurements provide objective data of value which, as this study shows, may be relied upon as being accurate and affected to only an insignificant extent by the personal error. This paper reports a study of the reliability of the keratometric or ophthalmometric measurements.

METHOD

A comparative study was made of the cases in which two keratometric measurements had been taken on the same patients* within a period of less than six months. A period of less than six months was impractical because only a few patients returned within a shorter period. Measurements on 50 unselected patients are reported, entailing 200 readings on 100 eyes. Despite the small number of cases used in this study, the results are so definite that it seems justifiable to present them at this time. The measurements were taken by six different examiners, but the majority of the readings were made by only two. The keratometers used were those made by the American Optical Company, by the Bausch and Lomb Opti-

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* None of the patients included had any corneal pathologic change or corneal irregularities.

cal Company, and by Carl Zeiss, Inc.; however, most of the measurements were taken on one instrument.

DATA

The data on 100 eyes are given in the following table (table 2.). The age of the patient, the repeated keratometric readings, the subjective refraction, the instrument used, and the initial of the examiner are included in the table.

The average age of the 50 patients included in this study was 32 years, the range being 8 years to 60. The average amount of corneal astigmatism measured in the 100 eyes was 1.32D; the range was from 0 to 5.25D. The average amount of subjective astigmatism for the 100 eyes was 1.09D.; the range was from 0 to 5.00D.

In the following tables (3 and 4), the differences in amount and axis of the corneal astigmatism between the repeated readings are summarized.

The maximum difference in the amount of the corneal astigmatism determined by the repeated readings was 0.75D.; the average difference in amount was 0.14D. In 68 percent of the cases the difference in amount was 0.12D. or less. In 92 percent the difference in amount was 0.25D. or less. This indicates that although a few deviations may be relatively large (the maximum being 0.75D.) most of the differences between repeated readings are very small (less than 0.25D.).

The maximum difference in axes between repeated readings was 15° but the average difference was only 3°. In 66 percent of the cases the variations in axes were 3° or less. In 87 percent of the cases the variations were 5° or less. These average deviations in amount and axis between repeated readings are very small.

An attempt was made to find a relation-

TABLE 2
REPEATED KERATOMETER READINGS

Pat.	Age	Double Readings*		Corneal Astigmatism	Differences		Examiner	Instrument	Subjective Astigmatism
		Primary Meridian	Secondary Meridian		Amt.	Axis			
1. JE	24	45.25/25	46.25/115	−1.00×25			B	B	
		46.00/20	46.75/110	−0.75×20	0.25	5	W	B	+1.50−0.25×180
		45.00/20	46.00/110	−1.00×20			B	B	
		45.25/7	46.25/97	−1.00×7	0	13	W	B	+1.75−0.50×180
2. ED	44	41.75/10	43.25/100	−1.50×10			W	B	
		41.25/176	43.25/86	−2.00×176	0.50	14	B	B	−1.50×178
		41.75/13	43.25/103	−1.50×13			W	B	
		41.25/13	43.12/103	−1.87×13	0.37	0	B	B	−1.50×10
3. WJ	27	43.62/20	43.25/110	−0.37×110			B	B	
		43.50/25	43.25/115	−0.25×115	0.12	5	B	B	−0.50×105
		43.50/25	44.00/115	−0.50×25			B	B	
		43.50/27	44.00/117	−0.50×27	0	2	B	B	−0.50×60
4. WW	26	41.75/3	43.25/93	−1.50×3			W	B	
		41.75/180	43.25/90	−1.50×180	0	3	B	B	+4.00−1.00×175
		42.00/10	43.00/100	−1.00×10			W	B	
		41.75/5	42.75/95	−1.00×5	0	5	B	B	+4.00−0.50×180
5. WC	30	40.00/167	39.75/77	−0.25×77			W	B	
		39.87/170	39.62/80	−0.25×80	0	3	W	B	+0.75−0.37×90
		39.50/108	39.87/18	−0.37×108			W	B	
		39.75	39.75	spherical	0.37	—	W	B	+1.00−0.25×90
6. AA	25	43.50/23	44.00/113	−0.50×23			W	B	
		43.37/22	43.75/112	−0.37×22	0.12	1	W	B	+1.25 sph.
		43.75/25	44.25/115	−0.50×25			W	B	
		43.62/20	44.12/110	−0.50×20	0	5	W	B	+1.00 sph.
7. VE	26	45.75/180	46.25/90	−0.50×180			B	B	
		45.75/180	46.00/90	−0.25×180	0.25	0	B	B	+0.12−0.12×70
		45.75/180	46.00/90	−0.25×180			B	B	
		45.75/180	46.00/90	−0.25×180	0	0	B	B	+0.12−0.12×90
8. DD	14	41.50/5	42.50/95	−1.00×5			B	B	
		41.25/5	42.50/95	−1.25×5	0.25	−	B	B	+0.50−0.50×5
		41.75/10	43.00/100	−1.25×10			B	B	
		41.37/10	42.50/100	−1.12×10	0.12	0	B	B	+0.50−0.50×175
9. DV	37	43.25/180	45.25/90	−2.00×180			B	B	
		43.50/180	45.50/90	−2.00×180	0	0	B	B	−1.75−2.00×180
		44.50/180	47.25/90	−2.75×180			B	B	
		44.75/180	47.50/90	−2.75×180	0	0	B	B	−1.50−2.25×180
10. WV	16	43.50/155	43.00/65	−0.50×65			B	B	
		43.50/152	43.00/62	−0.50×62	0	3	B	B	−1.75−1.50×65
		42.75/170	43.25/80	−0.50×170			B	B	
		42.75/170	43.50/80	−0.75×170	0.25	0	B	B	−1.25−0.75×125

TABLE 2—*Continued*

Pat.	Age	Double Readings* Primary Meridian	Secondary Meridian	Corneal Astigmatism	Differences Amt.	Axis	Examiner	Instrument	Subjective Astigmatism
11. EL	44	44.50/180	41.00/90	−3.50×90			W	B	
		44.50/180	41.00/90	−3.50×90	0	0	W	B	+1.75−4.25×90
		42.62/30	43.12/120	−0.50×30			W	B	
		42.75/32	43.37/122	−0.62×32	0.12	2	W	B	−0.25−0.50×180
12. WG	43	42.75/15	43.50/105	−0.75×15			B	B	
		42.50/10	43.50/100	−1.00×10	0.25	5	B	B	+1.00−0.25×180
		42.50/175	43.50/85	−1.00×175			B	B	
		42.75/180	43.75/90	−1.00×180	0	5	B	B	+1.00−0.25×180
13. FP	21	42.75/10	43.87/100	−1.12×10			E	B	
		43.00/10	44.25/100	−1.25×10	0.12	0	B	B	+1.00−0.25×180
		42.37/5	44.00/95	−1.62×5			E	B	
		42.75/5	44.25/95	−1.50×5	0.12	0	B	B	+1.00−0.25×180
14. LB	11	40.50/180	43.00/90	−2.50×180			H	A	
		40.87/180	43.12/90	−2.25×180	0.25	0	W	B	+7.25−2.00×175
		40.00/7	43.50/97	−3.50×7			H	A	
		40.62/8	43.37/98	−2.75×8	0.75	1	W	B	+8.25−2.25×5
15. EK	48	43.50/7	45.00/97	−1.50×7			W	B	
		43.25/5	45.00/95	−1.75×5	0.25	2	B	B	+1.25−1.75×180
		43.50/175	45.50/85	−2.00×175			W	B	
		43.50/175	45.50/85	−2.00×175	0	0	B	B	+1.25−2.00×170
16. JW	10	43.00/10	44.00/100	−1.00×10			B	B	
		43.00/5	44.00/95	−1.00×5	0	5	B	B	+1.50−0.50×180
		43.25/175	44.25/85	−1.00×175			B	B	
		43.00/175	44.00/85	−1.00×175	0	0	B	B	+1.50−0.50×180
17. RE	51	44.25/15	45.00/105	−0.75×15			B	B	
		44.12/15	45.00/105	−0.87×15	0.12	0	B	B	+2.00−0.50×30
		44.75/15	45.00/105	−0.25×15			B	B	
		45.00/20	45.25/110	−0.25×20	0	5	B	B	+1.75−0.50×110
18. IG	53	43.75/180	44.25/90	−0.50×180			B	B	
		43.87/175	44.25/85	−0.37×175	0.12	5	B	B	−0.50−0.50×70
		43.75/180	44.00/90	−0.25×180			B	B	
		44.00/180	44.25/90	−0.25×180	0	0	B	B	−0.25−0.25×90
19. WW	30	44.37/165	44.87/75	−0.50×165			W	B	
		44.12/160	44.62/70	−0.50×160	0	5	W	B	+0.25−0.75×120
		44.62/60	45.12/150	−0.50×60			W	B	
		45.00/45	44.50/135	−0.50×45	0	15	W	B	+0.50−1.00×65
20. EM	37	44.50	44.50	spherical			W	B	
		44.75	44.75	spherical	0	—	W	B	+1.75−0.50×90
		43.87/20	44.12/110	−0.25×20			W	B	
		44.12/10	44.50/100	−0.37×10	0.12	10	W	B	+1.50−0.50×105
21. CP	50	43.25/2	46.62/92	−3.37×2			W	B	
		43.25/2	47.00/92	−3.75×2	0.37	0	B	B	0.00−4.50×178

TABLE 2—*Continued*

Pat.	Age	Double Readings*		Corneal Astigmatism	Differences		Exam-iner	In-stru-ment	Subjective Astigmatism
		Primary Meridian	Secondary Meridian		Amt.	Axis			
		44.37/173	47.25/83	−2.87×173			W	B	
		44.25/176	47.25/86	−3.00×176	0.12	3	B	B	−0.75−3.00×2
22. MH	35	42.25/30	44.50/120	−2.25×30			B	B	
		42.50/32	44.50/122	−2.00×32	0.25	2	B	B	+2.25−1.25×30
		42.50/155	44.50/65	−2.00×155			B	B	
		42.25/152	44.37/62	−2.12×152	0.12	3	B	B	+2.25−1.25×150
23. CM	60	44.50/164	44.75/74	−0.25×164			W	B	
		44.37/165	44.62/75	−0.25×165	0	1	W	B	+2.50−2.00×90
		44.62/180	44.75/90	−0.12×180			W	B	
		44.62	44.62	spherical	0.12	—	W	B	+1.75−0.75×110
24. EB	20	41.50/3	46.50/93	−5.00×3			B	B	
		41.50/2	46.75/92	−5.25×2	0.25	1	B	B	+1.00−4.00× 3
		42.00/2	46.25/92	−4.25×2			B	B	
		41.75/2	46.25/92	−4.50×2	0.25	0	B	B	+1.00−3.00×177
25. FM	34	41.50/24	42.00/114	−0.50×24			W	B	
		41.37/20	41.75/110	−0.37×20	0.12	4	W	B	+1.00 sph.
		41.50/7	42.12/97	−0.62×7			W	B	
		41.37/6	42.37/96	−1.00×6	0.37	1	W	B	+1.50−0.25×130
26. RF	44	41.00/180	40.50/90	−0.50×90			M	C	
		41.50/170	40.50/80	−1.00×80	0.50	10	M	C	−0.25−1.25×80
		41.00	41.00	spherical			M	C	
		41.00/180	40.75/90	−0.25×90	0.25	—	M	C	−0.62−0.75×90
27. HR	41	43.75/7	46.00/97	−2.25×7			B	B	
		43.75/6	46.00/96	−2.25×6	0	1	B	B	+1.75−2.00×8
		44.00/174	45.25/84	−1.25×174			B	B	
		43.87/174	45.12/84	−1.25×174	0	0	B	B	+1.50−1.00×170
28. KK	52	41.25/140	42.75/50	−1.50×140			B	B	
		41.00/138	42.62/48	−1.62×138	0.12	2	B	B	+1.00−2.00×135
		41.12/30	42.62/120	−1.50×30			B	B	
		41.00/32	42.62/122	−1.62×32	0.12	2	B	B	+1.25−1.75×30
29. HW	43	43.50/180	44.25/90	−0.75×180			B	B	
		43.50/2	44.25/92	−0.75×2	0	2	B	B	0.00−0.25×120
		43.75/177	44.75/87	−1.00×177			B	B	
		43.75/180	44.75/90	−1.00×180	0	3	B	B	0.00−0.25×40
30. RC	31	41.75/2	44.12/92	−2.37×2			W	B	
		42.00/3	44.50/93	−2.50×3	0.12	1	B	B	+1.75−2.25×4
		42.25/7	44.50/97	−2.25×7			W	B	
		42.25/2	44.75/92	−2.50×2	0.25	5	B	B	+2.00−2.00×176
31. AC	26	44.25/180	44.75/90	−0.50×180			B	B	
		44.12/180	44.87/90	−0.75×180	0.25	0	B	B	0.00

TABLE 2—*Continued*

Pat.	Age	Double Readings*		Corneal Astigmatism	Differences		Exam-iner	In-stru-ment	Subjective Astigmatism
		Primary Meridian	Secondary Meridian		Amt.	Axis			
		44.00/180	45.25/90	−1.25×180			B	B	
		44.00/180	45.25/90	−1.25×180	0	0	B	B	0.00
32. LP	35	43.12/90	43.62/180	−0.50×90			W	B	
		42.87/100	43.12/10	−0.25×100	0.25	10	W	B	+1.00−1.00×90
		43.62/180	43.25/90	−0.37×90			W	B	
		43.25	43.25	spherical	0.37	—	W	B	+1.00−1.00×80
33. PB	19	43.87/180	44.00/90	−0.12×180			W	B	
		44.00	44.00	spherical	0.12	—	W	B	−0.25−0.25×100
		44.37/180	44.62/90	−0.25×180			W	B	
		44.25/180	44.75/90	−0.50×180	0.25	0	W	B	−0.50−0.12×75
34. JD	56	42.25/6	43.75/96	−1.50×6			W	B	
		40.62/180	42.25/90	−1.62×180	0.12	6	T	C	+1.50−0.62×175
		42.50/22	43.87/112	−1.37×22			W	B	
		41.25/10	42.50/100	−1.25×10	0.12	12	T	C	+2.00−1.00×30
35. PD	12	42.87/22	45.00/112	−2.12×22			W	B	
		42.87/19	44.87/109	−2.00×19	0.12	3	W	B	−13.00−3.00×30
		42.00/1	45.75/91	−3.75×1			W	B	
		41.87/2	45.37/92	−3.50×2	0.25	1	W	B	−8.00−5.00×170
36. EM	20	44.62/35	45.00/125	−0.37×35			W	B	
		44.50/38	44.62/128	−0.12×38	0.25	3	W	B	+0.50 sph.
		44.62/10	45.00/100	−0.37×10			W	B	
		44.37/15	44.87/105	−0.50×15	0.12	5	W	B	+0.75 sph.
37. JS	19	44.50/5	45.75/95	−1.25×5			B	B	
		45.00/10	46.37/100	−1.37×10	0.12	5	W	B	+0.50 sph.
		44.50/10	45.75/100	−1.25×10			B	B	
		44.75/20	45.87/110	−1.12×20	0.12	10	W	B	+0.50 sph.
38. KG	8	42.50/5	43.50/95	−1.00×5			H	?	
		42.75/180	43.62/90	−0.87×180	0.12	5	W	B	+2.75−0.50×180
		42.50/180	44.00/90	−1.50×180			H	?	
		42.75/6	44.25/96	−1.50×6	0	6	W	B	+2.75−1.00×180
39. CM	52	45.25/7	48.00/97	−2.75×7			W	B	
		44.75/7	46.25/97	−3.00×7	0.25	0	W	B	+0.50−1.25×168
		44.50/180	47.50/90	−3.00×180			W	B	
		44.50/1	47.25/91	−2.75×1	0.25	1	W	B	+1.00−1.25×10
40. HL	58	42.87/26	44.12/116	−1.25×26			W	B	
		43.00/30	44.12/120	−1.12×30	0.12	4	W	B	−0.25−1.50×40
		41.62/14	43.00/104	−1.37×14			W	B	
		41.50/16	42.62/106	−1.12×16	0.25	2	W	B	+0.50−0.50×180
41. ID	19	44.75/15	47.75/105	−3.00×15			B	B	
		44.50/15	47.50/105	−3.00×15	0	0	B	B	−0.50−2.50×17

TABLE 2—*Continued*

Pat.	Age	Double Readings*		Corneal Astigmatism	Differences		Exam-iner	In-stru-ment	Subjective Astigmatism
		Primary Meridian	Secondary Meridian		Amt.	Axis			
		44.50/160	48.00/70	−3.50×160			B	B	
		44.25/161	47.62/71	−3.37×161	0.12	1	B	B	+0.50−3.00×155
42. EF	22	42.50/16	43.00/106	−0.50×16			W	B	
		42.75/13	43.25/103	−0.50×13	0	3	W	B	+0.25−0.25×80
		42.75/9	43.25/99	−0.50×9			W	B	
		42.75/10	43.50/100	−0.75×10	0.25	1	W	B	+0.25−0.25×100
43. GB	24	43.50/14	44.00/104	−0.50×14			W	B	
		43.62/20	44.25/110	−0.62×20	0.12	6	W	B	+1.00−0.25×85
		43.25/12	44.25/102	−1.00×12			W	B	
		43.25/16	43.87/106	−0.62×16	0.37	4	W	B	−0.25−0.50×120
44. WL	27	43.50/3	47.75/93	−4.25×3			B	B	
		43.25/4	47.50/94	−4.25×4	0	1	B	B	+3.00−3.50×2
		43.50/2	48.00/92	−4.50×2			B	B	
		43.75/2	48.25/92	−4.50×2	0	0	B	B	+2.75−3.00×2
45. VO	48	44.00/170	42.00/80	−2.00×80			B	B	
		44.25/172	42.25/85	−2.00×83	0	3	B	B	−1.50−3.00×83
		44.25/20	43.75/110	−0.50×110			B	B	
		44.25/30	43.75/120	−0.50×120	0	10	B	B	+1.75−0.50×110
46. RL	21	42.87/22	43.37/112	−0.50×22			W	B	
		42.87/22	43.25/112	−0.37×22	0.12	0	W	B	+0.50 sph.
		42.62/7	43.37/97	−0.75×7			W	B	
		42.62/8	43.37/98	−0.75×8	0	1	W	B	+0.50 sph
47. MH	40	42.75/5	43.50/95	−0.75×5			W	B	
		42.62/180	43.62/90	−1.00×180	0.25	5	W	B	+0.50−0.50×180
		42.50/15	43.50/105	−1.00×15			W	B	
		42.37/10	43.50/100	−1.12×10	0.12	5	W	B	+0.50−0.50×180
48. JB	17	41.12/180	43.12/90	−2.00×180			W	B	
		41.00/2	42.75/92	−1.75×2	0.25	2	W	B	−1.00−0.75×160
		40.75/4	43.50/94	−3.25×4			W	B	
		40.12/5	43.37/95	−3.25×5	0	1	W	B	+3.25−3.25×5
49. RW	55	43.00/180	43.12/90	−0.12×180			T·	C	
		44.00/10	44.25/100	−0.25×10	0.12	10	W	B	+1.00−1.00×90
		42.75/180	43.50/90	−0.75×180			T	C	
		43.62/5	44.25/75	−0.62×5	0.12	5	W	B	Plano
50. RR	24	44.00/180	43.87/90	−0.12×90			W	B	
		43.87	43.87	spherical	0.12	—	W	B	−1.75−0.25×35
		43.87/33	44.12/123	−0.25×23			W	B	
		43.75/28	44.12/118	−0.37×28	0.12	5	W	B	−1.50 sph.

* For each case, the first two readings are for the right eye and the second set of two readings is for the left eye. The readings in the primary and secondary meridians are given and these meridians are noted by the figures following the slanted (/) line.

ship between the absolute amount of corneal astigmatism measured and the repeatability of the readings. The 34 cases in which there was no difference in amount between the repeated readings averaged 1.36D. of corneal astigmatism. The eight patients who had a maximum difference between readings (0.37D. or more) averaged 1.38D. of corneal astigmatism. That is, the amount of astigmatism measured was essentially the same in these two categories and was also substantially the same as the grand average of amount (1.32D. cyl.) of astigmatism for the 100 eyes. The repeatability of keratometric readings relative to the

TABLE 3

REPEATABILITY OF KERATOMETRIC READINGS AS TO AMOUNT

Difference in Amount diopters	Number of Cases	Cumulative Percentage of Cases
0.00	34	34
0.12	34	68
0.25	24	92
0.37	5	97
0.50	2	99
0.62	0	99
0.75	1	100

amount of astigmatism measured, is therefore independent of the total amount of astigmatism.

A similar attempt was made to find the relationship between the repeatability of axis determinations and the absolute amount of astigmatism measured. The results are given in table 5.

Since the axis position in seven cases of spherical corneas was indeterminate, these cases were excluded from this distribution. It is apparent from a study of the table that the lower the amount of corneal astigmatism the less repeatable are the axis determinations.

In analyzing the results by examiners and instruments the data have been classified into three groups:

TABLE 4

REPEATABILITY OF KERATOMETRIC READINGS AS TO AXIS

Difference in Axis degrees	Number of Cases	Cumulative Percentage of Cases
0	33	33
1	14	47
2	9	56
3	10	66
4	3	69
5	18	87
6	3	90
7	0	90
8	0	90
9	0	90
10	6	96
11	0	96
12	1	97
13	1	98
14	1	99
15	1	100

1. The repeated measurements in 36 eyes were taken by examiner B with instrument B*.
2. The repeated measurements in 38 eyes were taken by examiner W with instrument B*.
3. The repeated measurements in 26

TABLE 5

REPEATABILITY OF AXIS DETERMINATIONS RELATIVE TO THE AMOUNT OF KERATOMETRIC ASTIGMIA

Difference Between Repeated Axis Readings degrees	Number of Cases Included	Average Amount of Corneal Astigmatism diopters
0–2	49	1.84
3–4	13	1.18
5–6	21	0.87
7–9	0	—
10 and over	10	0.78

eyes were taken by a combination of the six examiners; that is, either both repeated reading were taken by examiners E, H, M, or T, or one reading was taken by one of the six

* Examiners B and W had an instrument of type B in their refracting rooms and therefore used it consistently.

examiners and the other readings by another examiner. In this last category the readings were taken with either one of the three instruments: A, B, C.

The results of this analysis are summarized in table 6.

TABLE 6
ANALYSIS OF RESULTS BY EXAMINERS AND INSTRUMENTS

Examiner	Number of Eyes	Instrument	Average Deviation
B	36	B	0.09
W	38	B	0.14
All	26	All	0.20

The average deviations between repeated readings varied in the different categories from the total average deviation (0.14D.) by ±0.06D. There was a small variation between the readings taken by different examiners on the same instrument, indicating that the variations are not due to the different instruments. One can conclude, therefore, that keratometric readings are influenced only to a very small degree by the discriminative ability of the examiner.

It was thought that the slight variations in repeated readings were due to involuntary movements of the patients' eyes. Therefore, repeated readings were taken on an artificial (glass) cornea* having an astigmatism of 1.62D., which was rigidly mounted before the keratometer. The repeatability of successive readings taken by examiners B and W on the glass cornea showed variations similar in amount and in axis to those found on human subjects. This would indicate that movements on the part of the patients did not account for the variations found in this study.

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* We are indebted to F. W. Jobe of the Bausch & Lomb Optical Company, who kindly loaned us the glass cornea and attachments for mounting it before the keratometer.

SUMMARY AND CONCLUSIONS

1. The analysis of repeatability tests on the keratometer indicates that these readings are quite repeatable in determining the amount and axis of the corneal astigmatism.

2. In rare cases the difference in amount between repeated keratometric measurements may be relatively high. In this study of 100 eyes there was one case with a difference between repeated readings of 0.75D. In the majority of cases (92 percent) the deviation was 0.25D. or less.

3. Similarly, in a few cases the difference in axes between repeated keratometric readings was as high as 15°, but in the majority of cases (87 percent) the difference was 5° or less.

4. No relationship was found between the total amount of corneal astigmatism and the repeatability of the amount of the readings.

5. On the other hand, there was a definite relationship between the total amount of corneal astigmatism and the repeatability of the axis readings. That is, the higher the amount of corneal astigmatism the more dependable were the axis determinations.

6. This study of the repeatability of keratometric readings on 100 eyes indicates that the keratometer is a reliable instrument for the measurement of corneal curvatures and that the importance of the interpretation of individual examiners is negligible. The stability of the corneal curvatures is verified by the constancy of repeated readings.

7. The role of the keratometric readings in the eventual diagnosis and therapy, although difficult to analyze, is important because one can be guided by the accuracy and consistency of corneal curvatures and interpret changes in subjective refraction in terms of factors other than the cornea.

Significant differences in subjective refraction not substantiated by changes in corneal curvature must indicate lenticular or indicial changes. This information may be of diagnostic value.

8. Since the cornea constitutes four fifths of the refracting power of the eye, since its front surface can be *accurately* measured by the keratometer, and since changes or lack of changes in its curvature may have diagnostic importance, it seems worthwhile to recommend the keratometer as an important adjunct to the battery of instruments and techniques used in refractive measurements.

4 Webster Avenue.

REFERENCES

[1] Ogle, K. N.; Imus, H. A.; Madigan, L. F.; Bannon, R. E.; and Wilson, E. C.   Repeatability of ophthalmo-eikonometer measurements. Arch. of Ophth., 1940, v. 24, pp. 1179-89.

[2] Ogle, K. N.   Some aspects of the eye as an image-forming mechanism. Jour. Opt. Soc. of Amer., 1943, v. 33, pp. 506-512.

[3] Ogle, K. N., and Madigan, L. F.   Astigmatism at oblique axes and binocular stereoscopic spatial localization. Arch. of Ophth., 1945, v. 33, pp. 116-127.

NOTES, CASES, INSTRUMENTS

A CASE OF MULTIPLE TUBER- CULOUS NODULES OF THE EPISCLERA*

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Episcleritis and scleritis of a tuberculous origin are rare diseases. American literature does not contain many reports of these lesions; most of them are to be found in the foreign literature.

The question as to whether these lesions, which are nodular in appearance, are scleral or episcleral frequently cannot be answered. The site of origin is most probably in the episcleral tissue, and as the nodule increases in size, it begins to involve the conjunctiva and the outer and middle layers of the sclera. There are many transitional forms, which can involve the sclera alone or the episcleral tissue to a lesser or greater degree. Many investigators believe that in cases of deep tuberculous scleritis there must be uveal involvement. Pollack[1] has reported a case of an isolated tubercle of the sclera without involvement of the uvea. Many of the German authors write of tuberculous conjunctivitis and episcleritis, because of their feeling that the two cannot be separated.

The question as to whether these nodules are primary tuberculous infections or secondary in nature has been discussed at length by Schieck,[2] Junius,[3] Davids,[4] and others. Schieck, in considering the mode of origin of tuberculosis of the conjunctiva and episclera, came to the following conclusions on the basis of the work of Ranke and Igersheimer[5]: (1)

That the tubercle bacillus can penetrate the conjunctiva without causing a lesion in it. (2) That the diagnosis of primary tuberculosis of the conjunctiva requires a swelling of the regional lymph nodes. (3) That those cases of tuberculosis of the episclera without such swelling must be considered endogenous or secondary in nature.

Most other authors believe these lesions to be secondary in nature. Krückmann[6] also stated that tuberculosis of the eye is rarely associated with tuberculosis of the lung, but is frequently associated with tuberculosis of the thorax and abdomen. It is a well-known fact that in tuberculosis sanitaria, where patients with active lung lesions are found, there are exceptionally few cases of ocular tuberculosis.

Most reports in the literature deal with individual tuberculous nodules; Duke-Elder[7] noted several nodules forming intermittently; and Schultz[8] has reported a case of multiple nodules of the conjunctiva and episclera. The last named writer excised one of the nodules and found it to be typical tuberculous granulation tissue, but no tubercle bacilli were found. In this case the nodules became confluent and then ulcerated. The entire area was then covered with connective tissue. The patient showed old corneal opacities of both eyes. X-ray studies of the chest showed a tuberculous lesion on the right side.

In determining the differential diagnosis, the following conditions must be considered:

1. Phlyctenular conjunctivitis. This is distinguished by a nodule in the conjunctiva which is surrounded by conjunctival vessels. It is not painful on palpation and is associated with some form of dietary deficiency.

2. Episcleritis associated with rheuma-

toid arthritis, the lesions of which are single with a superficial vascularization usually near the limbus. The patient complains of pain, photophobia, and lacrimation. There is a history of rheumatoid arthritis.

3. Anterior scleritis is a diffuse swelling of the anterior segment of the globe, more extensive than the nodules of episcleritis. Several nodular areas fuse, until in the worst cases the inflammation extends entirely around the cornea to form an annular scleritis.

4. Lymphoma of the conjunctiva is characterized by a transparent edematous mass which is not nodular in appearance. It occurs in the subconjunctival tissue and is frequently associated with hyperplasia of the lymphoid and blood-forming tissues.

5. Gelatinous or brawny scleritis is a diffuse swelling of the sclera which may hang down over the cornea. It has a gelatinous and succulent appearance. Eventually it infiltrates the cornea and opacifies it. It is frequently associated with more or less severe uveitis.

The case reported here is one of multiple tuberculous nodules of the episclera and sclera.
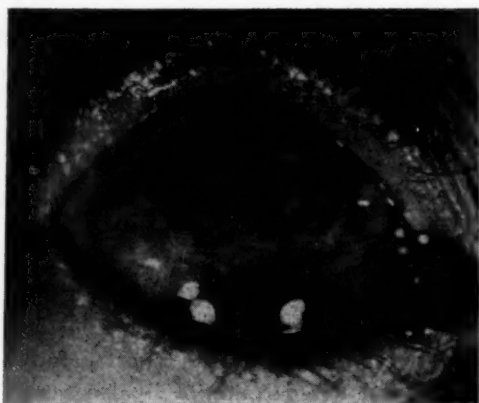
Fig. 1 (Kronenberg). Multiple tuberculous nodules of the episclera.
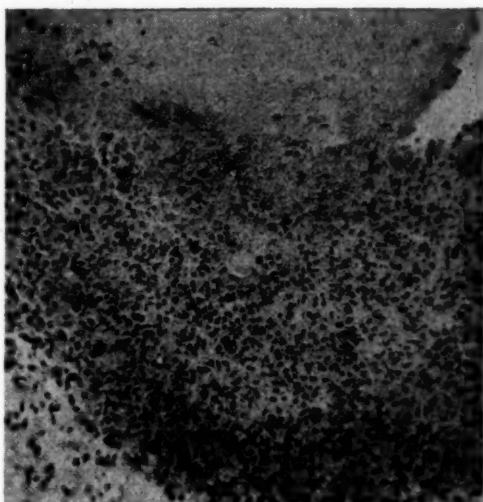
Fig. 2 (Kronenberg). Photomicrograph of section through a tuberculous nodule ×125.

D. K., a white woman, aged 64 years, had noticed in April, 1944, that the upper part of the right eye was inflamed and painful. There was no photophobia, and no discharge (fig. 1). At the age of 3 years both eyes had been inflamed after an attack of measles. Her general condition at present (blood pressure, urinalysis, and Wassermann test) were within normal limits. The chest, however, gave evidence of an active tuberculous lesion in the left upper lobe of the lung.

Ocular findings: Vision O.D. was 20/100; O.S., 20/400. The conjunctiva below was clear. In the area involved there was an edema of the conjunctiva with dilation and engorgement of the conjunctival vessels. Under the conjunctiva there were several small yellowish nodules.

The cornea of the right eye, centrally, presented an old opacity, localized under the epithelium. At the 4- and the 2-o'clock positions there were infiltrates extending from the limbus for 2 mm., with conjunctival vessels going to them. In the left eye also a central large opacity was localized under the epithelium, but contained

no vessels. Nasally there were some vessels going from the limbus.

The fundi were not clearly observable.

One of the nodules was excised and the pathologic report as given by Dr. A. Sala follows:

"The lesion consists of a central mass of necrotic tissue, caseous material, and fragments of nuclei here and there. This central debris is surrounded by some epithelioid cells and lymphocytes. One or two giant cells are to be seen. The histologic diagnosis is tuberculosis. Stains for tubercle bacilli were negative, but the histologic examination is characteristic of a tuberculous lesion" (fig. 2).

At present the patient is beginning to show signs of a thinning of the sclera in the area involved and exhibiting the characteristic bluish color. She is receiving tuberculin therapy.

This case is reported because of the following unusual features:

1. There are few reports of multiple nodules of this nature.

2. Its association with an active lung lesion demonstrates the fact that it is metastatic in nature. This adds to the evidence that is accumulating that these lesions are secondary in nature.

3. A biopsy specimen was obtained so that the diagnosis of a tuberculous lesion could be established on a histologic basis.

4. This case demonstrates that deep tubercular scleritis can occur without involvement of the uvea.

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REFERENCES

[1] Pollack.   Klin. M. f. Augenh., 1932, v. 88, p. 747.
[2] Schieck.   In Schieck and Brückner's Kurzes Handbuch der Ophthalmologie. Berlin, Julius Springer, 1931, v. 4, p. 96.
[3] Junius.   Arch. f. Augenh., 1929, vv. 100/101, p. 164.
[4] Davids.   Arch. f. Augenh., 1932, v. 106, p. 293.
[5] Igersheimer.   Klin. M. f. Augenh., 1932, v. 69, p. 226.
[6] Krückmann.   Zusammenkunft d. Deutsch. Ophth. Gesellschaft, Heidelberg, 1928, p. 64.
[7] Duke-Elder.   Text-book of ophthalmology. St. Louis, C. V. Mosby Co., 1938, v. 2, p. 2047.
[8] Schultz.   Klin. M. f. Augenh., 1924, v. 72, p. 495.

A TENDON-TRANSPLANTATION TECHNIQUE FOR EXTERNAL-RECTUS PARALYSIS*

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Because of the medial origin of both the superior and inferior recti, and because of the attachment of a part of their tendons nasal to the vertical meridian of the eyeball, a subsidiary function of these muscles is internal rotation. In external-rectus paralysis, transplantation of the whole of the vertical-rectus tendons to a position temporal to the median vertical plane largely converts the internal rotation of these muscles into the more desirable action of external rotation. O'Connor[1] has achieved this in three ways: (1) by laying the inner halves of the vertical-rectus tendons over the lateral halves; (2) by transplanting the whole; or (3) by transplanting the inner halves of the vertical-rectus tendons to the corresponding borders of the external rectus.

The following technique is also a successful means of applying this principle to external-rectus paralysis (fig. 1). The

external rectus is resected but not immediately reattached to the sclera. Through the same conjunctival incision the vertical-rectus muscles are exposed one at a time. Their tendons are split in the middle with a sharp hook, and the muscle is divided back for an additional 10 mm. with scissors. The outer muscle slip thus formed is transplanted to the sclera behind the insertion of the external-rectus muscle. The inner muscle slip is transplanted to the position previously occupied by the outer muscle slip. The resected external rectus is replaced to its original attachment. Most cases of external-rectus paralysis are not treated surgically until complicated by some degree of internal-rectus contracture. A recession upon this muscle can usually be done to advantage.

The vertical recti can be split back as far as possible without injury to their innervation because the nerves enter these muscles at the junction of the posterior and middle thirds. The transplanted muscle slips ride smoothly across the sclera without excessive tension. By means of the new attachment of the vertical recti, a strong action of external rotation opposes the internal rectus.

Case 1. A girl, aged nine years, had congenital bilateral external-rectus paralysis and a 30-degree left internal strabismus. Vision: R.E. 6/7.5—3; L.E. 6/12—1.

A strong left internal rectus was recessed 5.5 mm. The external rectus was resected 6 mm. The outer three fifths of the vertical recti were transplanted to a point behind the insertion of the external rectus; the nasal tendon slips were moved to the outermost insertions of the vertical recti. Postoperatively, 14 degrees of right hypertropia and 20 degrees of exotropia existed. The left eye could be rotated 48 degrees externally. Two months after the

first operation, the left internal rectus was advanced 5 mm. I did not see this patient again, but when seen in the same clinic two months following the last operation, she was reported to have 6 degrees of exophoria and some right hyperphoria. Internal rotation for the left eye was 40
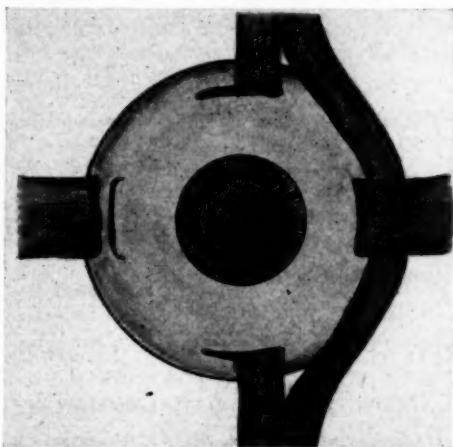
Fig. 1 (Lutman). Tendon transplantation technique for external-rectus paralysis.

degrees and external rotation 35 degrees.

Case 2. A girl, aged 17 years, was semi-comatose for a week following a motorcycle accident in June, 1943. Skull X-ray studies at the time revealed no fracture. Upon regaining consciousness the patient had no sensation on the left side of her face, and her left eye was nearly blind. She could not rotate the right eye externally to the midline. Nine months after the accident, when I first saw her, the left side of her face was hyperesthetic. No tears were shed from either eye when she "cried." Vision was: R.E. 6/7.5+3; L.E. the perception of fingers at one foot. The optic disc of the left eye was chalky white from primary atrophy. The patient's head was constantly rotated far to the right. External rotation of the right eye was limited to 18 degrees nasal to the midline.

Ten months after the accident, with the patient under a general anesthesia, the right eye could be rotated outward with the aid of tissue forceps against a moderate amount of resistance from the contracted internal rectus. The internal rectus was recessed 4 mm. The external rectus was resected 5 mm. The outer halves of the vertical recti were transplanted to a point behind the insertion of the external rectus. The inner halves of the vertical recti were transplanted to the normal attachment of the outer halves of these muscles. Postoperatively, the eyes were straight in the primary position without head rotation. The right eye could be rotated externally 23 degrees.

REFERENCE

[1] O'Connor, Roderic. Tendon transplantation in ocular-muscle paralysis. Amer. Jour. Ophth., 1935, v. 18, Sept., pp. 813-820.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE

ROYAL SOCIETY OF MEDICINE

SECTION OF OPHTHALMOLOGY

November 9, 1944

MR. P. E. H. ADAMS, *president*

Abstracted by permission from the Proceedings of the Royal Society of Medicine (Section of Ophthalmology), 1945, volume 38, no. 2, sectional page 11.

AN INSTRUMENT FOR TESTING DARK ADAPTATION

MR. E. W. GODDING presented a paper on this subject and described in various stages the apparatus used in measuring dark adaptation.

STUDIES IN DARK ADAPTATION IN THE DETECTION OF DEFICIENCY OF VITAMIN A

CAPTAIN JOHN YUDKIN, RAMC, presented a paper on this subject summarized as follows:

(1) If vitamin A affects any part of the dark-adaptation curve, it always affects the final rod threshold; other parts of the curve may or may not be affected. It follows that if only one point in the curve is to be measured it should be the final rod threshold.

(2) In order to prove the existence of vitamin-A deficiency by measuring dark adaptation, it is necessary to apply the therapeutic test; that is, to see whether the dark adaptation is improved after the administration of the vitamin.

(3) Although the therapeutic test is essential in order to detect deficiency in an individual and desirable in groups, it is not always practicable to apply it to groups. In this case, presumptive evidence of deficiency may be obtained by comparing the dark adaptation of different groups.

(4) Since age affects dark adaptation, it is necessary either to allow for this in comparing groups of different ages or to compare groups of similar age.

Discussion. Dr. H. Pollak, Major R. E. Wright, Dr. W. D. Wright, Mr. D. V. Giri, Mr. F. A. Juler, Dr. Z. A. Leitner, Dr. H. S. Stannus, and Mr. E. W. Godding discussed this paper.

THE HERBERT IRIS-INCARCERATION METHOD OF OPERATION FOR GLAUCOMA

DR. MARY CRIPPS gave a demonstra-

tion of the visual fields before and after operation. She had used the Herbert iris-incarceration method in 306 cases, and the following were her conclusions as to the result.

I. Glaucoma with tension ranging from normal to 70 mm. Hg (Schiøtz)

In those cases of chronic glaucoma whether or not an acute or subacute attack has been superimposed on the chronic state, and if the tension varies from 25 mm. Hg to 70 mm. Hg (Schiøtz) and can be reduced (by appropriate methods) down to about normal, and if the field of vision varies from a sickle-shaped scotoma and peripheral depression (early stages) down to the more advanced stages of a restricted field and sloping-edged defects with depression of central vision—provided that not more than half of the fixation area within the 5-degree circle has been invaded—then the vision improves with the Herbert operation.

II. Glaucoma with tension above 70 mm. Hg

Included under this heading are those cases, whether suddenly acute or ordinarily chronic, wherein the tension has risen above 70 mm. Hg and can be reduced by intravenous glucose to normal limits but which rapidly rises again, and wherein the vision is reduced.

(a) In those cases wherein more than half of the fixation area has been invaded and there are doubtful areas of vision, the operation gives only relief from pain and tension, and the vision is liable to deteriorate.

(b) In those cases wherein vision is reduced to perception of light in the upper temporal quadrant the Herbert operation gives increased vision in this quadrant with reduction in tension to normal limits.

However, in these cases the operation must be modified, the edges of the incision are punched with a Lagrange punch before the fibrotic strands of the permanently dilated iris can be incarcerated.

Sclerosis of the lens which may exist in these cases of prolonged tension is inclined to increase but as soon as the sclerosis has progressed sufficiently the lens is easily removed because the gap in the iris already exists and the fibrosed iris tissue of the filtering scar lies deep to the cataract incision. The wound heals normally without subsequent increase of tension.

RETINIS CIRCINATA OF UNKNOWN ORIGIN IN A CHILD

MR. O. GAYER MORGAN presented an eight-year-old boy. His mother said he had complained of difficulty in reading. The vision was R.E. 6/18; L.E. 6/5. The fundus showed very marked retinitis circinata, with a small reddish or orange central spot which was just above the macula. The only relevant history was that he had had concussion a year previously, was bruised on the right side of his face, and the eye was closed. He was entirely healthy except that he suffered from asthma. He had a very large head, which might denote a mild degree of hydrocephalus, but it was a family trait to have large heads. His eye condition, presumably, was one of edema and hemorrhages, and it might have been considered a case of early Coats's disease; however, contraindications were that there were no engorged or large vessels, or angiomatous-looking enlargements, no deep swelling, and no detachment. It might have been a hemorrhagic condition as a result of the fall, but it was a little difficult to see how it could cause such retinitis circinata. It might have been one of those types of edema of the retina, usually unilateral, which occurs in children or young people for no apparent reason, and in which no actual cause of the process can be found. Mr. Morgan was anxious to know

whether anyone had seen anything like this before.

Discussion. Mr. Adams said that he presumed it might have been traumatic if, as a result of concussion, he had extensive choroidal hemorrhage with damage to the macula, the retinitis having developed subsequent to that.

QUESTIONARLE CONJUNCTIVAL EPITHELIOMA. QUESTIONABLE ATYPICAL MOOREN'S ULCER SUPERIMPOSED ON OLD MUSTARD-GAS DAMAGE

MR. ALAN HOLMES-SMITH presented a man, aged 60 years. There was a history of damage to the left eye by mustard gas in 1918. At that time he was hospitalized and treated for three months. During the past two or three months the lids of the left eye had become swollen. The swelling receded with the use of hot compresses. For three weeks prior to this examination there was ptosis of the left eyelid.

The vision was R.E. 6/24, L.E. ability to count fingers.

The right eye was normal on examination. The left eye showed an inactive pupil and no red reflex. The tension was normal. There was a firm raised area of conjunctiva below and medial to the limbus, extending into the lower fornix; the edge was raised. The lower nasal quadrant of the cornea was involved in the lesion, and an opaque area separated it from normal cornea. No enlarged glands were palpable in the neck.

Mr. Holmes-Smith said that there was some difference of opinion as to the diagnosis, whether it was an atypical Mooren's ulcer or a new growth. It was finally decided to enucleate the eye, and that was done completely with as much conjunctiva as could be taken from the lower fornix. On section the tumor was thought to be an epithelioma with considerable inflammatory reaction, with the sclera undergoing invasion at the limbus. A course of radiotherapeutic treatment has been advised.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

December 4, 1944

DR. MILTON L. BERLINER, *presiding*

SYPHILITIC OPTIC ATROPHY AND TRYPARSAMIDE AMBLYOPIA

DR. H. HOUSTON MERRITT said that syphilitic optic atrophy may be secondary to meningeal involvement of the nerve or luetic chorioretinitis, but more frequently it is primary. Primary luetic optic atrophy may be the only manifestation of the disease, although more frequently it is seen with tabes dorsalis. The exact pathogenesis is not clearly elucidated but it is probably due to primary involvement of the nerve itself or its blood vessels by the disease. Spirochetes have been found pathologically in only two cases, both by Igersheimer. The characteristic visual defect consists of loss of central field with concentric or sector-shaped peripheral constriction. The course is progressively downhill and if one eye is involved the other may be expected to show the same condition within seven years. Useful vision may likewise be expected to be lost within seven years after the condition is recognized. Until recent years treatment has been ineffective, whether in the form of trivalent arsenicals, tryparsamide, or the Swift-Ellis method of arsenical treatment. Fever therapy is accepted today and if instituted sufficiently early, offers a 60-percent chance of arresting the condition. Penicillin has not been in use for a long enough period of time to determine its usefulness.

Optic atrophy may be caused by tryparsamide. It is known that other pentavalent arsenicals have an affinity for the

optic nerve in experimental animals. It has been found that 8 percent of patients under tryparsamide treatment experience some visual phenomenon. In half of these patients this is purely subjective and not serious. A few hours after the injection the patient's vision is blurred for several hours by a shining mist, such as may be seen over a hot radiator. This will not recur if the tryparsamide is discontinued, but if the drug is continued blindness can develop with the fundus appearing normal. This blindness improves later with the return of central vision, but the visual field continues to be of a funnel type. Atrophy becomes detectable after several weeks. This visual disturbance usually occurs after the first few tryparsamide injections and is unusual, but possible, after the eighth injection.

Although it has been claimed that the tryparsamide does not directly induce the blindness but lights up syphilis already in the eye, the great speed of the appearance of the blindness (three hours) indicates that the drug itself is at fault. Also, there have been cases of blindness after tryparsamide administration to nonsyphilitic individuals. When tryparsamide is administered there are three safeguards against these complications: (1) ophthalmoscopic and visual-field examinations are performed to weed out abnormal cases, as these show 10 times the frequency of the complications; (2) only small doses should be administered at first; and (3) be on the alert for subjective symptoms.

Discussion. Dr. James W. Smith thought that Dr. Merritt stressed a point of practical importance regarding the poor visual prognosis in tabes either with or without therapy. If the inexperienced ophthalmologist fails to recognize this, he will be blamed by the patient for authorizing a therapy that induced blindness. Close coöperation is essential between the syphilologist and eye physician before

therapy with tryparsamide is started. Unfortunately, in some cases wherein there is vision and field loss other systemic disease may contraindicate fever therapy. Unless penicillin is proved effective against cerebrospinal syphilis, the doctor will still be confronted with a dilemma.

Dr. Merritt thanked Dr. Smith for reemphasizing the importance of close coöperation between the ophthalmologist and syphilologist in the treatment of these cases of optic atrophy. Although some claim that all patients with syphilitic optic atrophy will be blind within seven years, he said that he did not believe that this was necessarily true. It is probable that some cases come to a spontaneous arrest. He did not believe justified the feeling of some ophthalmologists and syphilologists that tryparsamide can be used in the treatment of patients with optic atrophy. At the present time fever treatment is the method of choice. When using tryparsamide in the treatment of neurosyphilis, one should be very careful to watch for the development of visual symptoms, as it is a powerful and dangerous weapon.

INVOLVEMENT OF THE OCULAR SYSTEM IN DEMYELINATING DISEASES

Dr. Armando Ferraro presented a table summarizing the most important manifestations of involvement of the ocular system in various types of demyelinating diseases; such as multiple sclerosis, diffuse sclerosis, Schilder's disease, Devic's disease, Balo's disease, Krabbe's disease, and so forth.

He attempted to establish that from the clinical as well as the pathologic standpoint, all these various supposedly clinico-pathologic entities are nothing else but variants of the same fundamental process of demyelination of the central nervous system, in relation to age at onset, resistance of the individual, and virulence of the pathogenic factor.

He attempted further to make a comparison between the most important features of the histopathologic process of the various demyelinating diseases with the main features of allergic reaction of the brain. The material for such a comparison came from the Department of Neuropathology of the New York State Psychiatric Institute where since 1940 Dr. Ferraro, first in collaboration with Jervis, and then with the Kopeloffs, investigated the reaction of the nervous tissue to experimental allergy. Briefly, the essential features of experimental allergy, such as demyelination, vascular infiltration—first with polymorphonuclear cells and then with lymphocytes and histiocytes—reactive pliosis, presence of edema, occasional hemorrhages, presence of granulomatous-like formation with giant cells, occasional thrombi of small blood vessels, and occasional endarteritis, are all features which may be found in the so-called demyelinating diseases.

Dr. Ferraro drew the conclusion that the pathology of the demyelinating diseases including the pathology of the ocular system may be viewed also in the light of an allergic reaction.

Discussion. Dr. Daniel Kravitz said that ophthalmologists are dismayed by the large number of names which describe apparently similar conditions. The situation is analogous to the practice of attaching names to every corneal spot which appears somewhat different from the others. Regarding the possible allergic basis for the causation of the demyelinating diseases, Dr. Kravitz believed it too great a simplification. Here again one is reminded of the variety of ocular conditions explained by some as due to a single cause, vasoconstriction. Allergy as a cause for the demyelinating diseases does not explain the large number of familial cases in which patients reach a certain station in life and then are attacked by these diseases.

TOPICAL DIAGNOSIS OF DISTURBED OCULO-
MOTOR MOTILITY

DR. ALFRED KESTENBAUM differentiated between types of palsy of muscles supplied by the oculomotor nerve:

(1) Nuclear type: The arrangement of the centers for the individual eye muscles in the third-nerve nucleus is still controversial but it is more or less accepted that the cranial (superior) part represents the homolateral levator and superior rectus. Below these centers is the center for the inferior oblique of the same side. The inferior part of the nucleus and the neighboring trochlear nucleus represent the contralateral inferior rectus and superior oblique, respectively, and their fibers must cross the midline. The medial rectus is represented in the medial parts of both oculomotor nuclei. Briefly, the elevators have their centers homolaterally, the depressors contralaterally, and the medial rectus bilaterally. Owing to this complex arrangement a single focus in the nucleus cannot involve all the muscles supplied by the oculomotor nerve of one eye, and complete oculomotor palsy of one eye excludes a nuclear lesion. Partial oculomotor palsy is more frequent if the lesion is nuclear than if it is subnuclear. Bilateral paresis of single muscles indicates a nuclear lesion.

(2) Dorsal fascicular type: A lesion here, usually accompanied by involvement of the nucleus ruber or of the substantia nigra, shows also a disturbance of the tonus, muscular coördination, and sometimes sensibility of the opposite half of the body. This corresponds to the old "Benedict's syndrome," oculomotor palsy, and crossed hemitremor.

(3A) Ventral fascicle type: Here a lesion is usually associated with a pyramidal-tract lesion in the pes pedunculi, resulting in Weber's syndrome, oculomotoi palsy, and crossed hemiplegia.

(3B) Root type: A lesion of the root

of the third nerve, after it leaves the brain stem at the medial side of the peduncle, also results in a Weber's syndrome, which therefore is ambiguous, being due to a lesion in the brainstem or one in the interpeduncular region.

(4) Basal type: After leaving the brainstem, the third nerve passes forward in the subarachnoid space at the base of the brain, first mesial, then below the peduncle, and then between the posterior cerebral artery and the superior cerebellar artery for a total of 2 cm. before perforating the arachnoid and dura to enter the extradural space. In its "basal" portion the nerve may be damaged by basal meningitis, a tumor, or especially an aneurysm of one of the aforementioned arteries. This type of oculomotor palsy may be monosymptomatic and its topical diagnosis very difficult. A Wassermann test and arteriography, which is not harmless, may aid localization.

(5) and (6) Posterior and anterior cavernous-sinus types: From the point of penetration of the dura until it reaches the superior orbital fissure, the nerve runs within the wall of the cavernous sinus. In addition to the oculomotor palsy, there may be signs of a lesion of the cavernous sinus and involvement of the neighboring fourth, fifth, and sixth nerves. The first and second branches of the trigeminal may be involved only in the posterior cavernous-sinus type of lesion, whereas in the more anterior lesions only the first branch of the fifth nerve is implicated; while a thrombosis of the cavernous sinus and an arteriovenous aneurysm of the carotid artery without venous communication may be symptomless except for the palsy and therefore resemble the basal type of lesion.

(7) Orbital-fissure type: Here the third, fourth, fifth, and sixth nerves are involved, but there are no signs of a cavernous-sinus lesion.

(8) Orbital apex type: A lesion in the apex of the orbit presents signs of third-, fourth-, fifth-, and sixth-nerve disease and also optic-nerve involvement, with central scotoma progressing to blindness, temporal pallor becoming optic atrophy, and, if the lesion takes space, exophthalmos is also present.

(9) Muscular type: The previously mentioned types of third-nerve palsy must be differentiated from lesions in the muscles themselves, as occurring in the nerve endings in myasthenia gravis, or with orbital tumors. In the muscular type of lesions either all or part of the extraocular muscles are involved, and in the latter case the muscles are involved independently of their innervation. For example, a tumor above the eye may involve the superior rectus and oblique muscles, which are innervated by different nerves.

(10) Neuritis type: Neuritis, or other processes restricted to the nerve itself, as in diabetes, infections, intoxications, may produce monosymptomatic oculomotor palsy which may be confused with the basal type.

Discussion. Dr. Percy Fridenberg pointed out that a very early symptom of fifth-nerve involvement in orbital-apex and fissure lesions is silent and must be elicited. This is anesthesia of the frontal branch, missed by most ophthalmologists, but later becoming a severe neuralgia.

Dr. Kestenbaum stated that the diagnosis of anesthesia of the trigeminus cannot be based upon the loss of the corneal reflex alone, but all regions supplied by the nerve must be tested. X-ray studies are of great importance in topical diagnosis but were not discussed. It should be emphasized that the final diagnosis is made by the neurologist; that the ophthalmologist can only interpret the ocular sign to further his purpose.

Leon H. Ehrlich,
Secretary.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

January 8, 1945

DR. T. F. LEATHERWOOD, *presiding*

SYMPATHETIC OPHTHALMITIS FOLLOWING IRIDENCLEISIS

DR. RALPH O. RYCHENER reported a case of sympathetic ophthalmitis with loss of vision in both eyes following iridencleisis for simple glaucoma. Mrs. I. H., aged 64 years, was seen on June 4, 1943, for a routine eye examination. She had no complaints other than an occasional blurring of vision in the right eye and burning and itching of both eyes. The vision was R.E. 6/7.5, improved to 6/6 with −.50D. sph.; L.E. 6/20, improved to 6/6 partly with +1.00D. sph. ⌖ +.25D. cyl. ax. 90°. The addition of a +2.50D. sph. enabled her to read Jaeger 1 with each eye.

Ophthalmoscopic examination disclosed some lens haze and glaucomatous cupping of the disc of the right eye. Lens haze was present in the left eye and the disc was normal. The tension was R.E. 37 mm., L.E. 25 mm. Hg (Schiøtz). There was slight concentric contraction of the visual field of the right eye. The patient was given 1-percent solution of pilocarpine for use in the right eye four times daily and was seen rather frequently until October 26, 1943, during which time the right eye became more myopic, visual acuity decreased to 6/7.5, partly, with correction, and the tension could not be controlled by other miotics. Operation was advised, and on November 1, 1943, iridencleisis was performed on the right eye. There were no surgical difficulties of any kind, convalescence was uneventful, and the tension remained below 20 mm. until December 6th, when she

returned with the left eye red and painful, and the vision diminished to 6/24. Plastic iritis was present in both eyes, and, although posterior synechiae were present, the iris responded well to the instillation of epinephrine-bitartrate crystals.

The patient was hospitalized and given foreign proteins and aspirin in large amounts and made some progress. During this time she developed atropine dermatitis and obtained general toxic symptoms from scopolamine ointment, 0.5-percent.

On January 4th new vessels had appeared on the iris of the right eye so as to give the impression of rubeosis. Two infected, unerupted milk teeth were removed, further foreign-protein therapy was administered, plus pilocarpine sweats and glucose intravenously for cyclic vomiting, but the inflammatory changes progressed until hyalitis, uveal cataract, and angular synechiae with diminution of vision to light perception presented the final picture of the end result of sympathetic ophthalmitis.

Enucleation of the right eye was performed on April 6, 1944, because of intractable pain. Following is the report of the microscopic examination by Col. J. E. Ash of the Army Medical Museum:

"Microscopic: There is a scar of a perforating wound of the cornea at the limbus. There appears to be a coloboma of the iris on this side but the rest of the iris and the ciliary body are greatly thickened by a massive granulomatous inflammatory process which also involves the scar and adjacent conjunctiva. Areas of necrosis in the conjunctiva, which appear to have reached the point of caseation, are surrounded by radiating epithelioid cells. There is pigment in and around these tuberclelike lesions and around one of them are giant cells which contain refractile foreign bodies. There is no evidence of caseation in the intra-

ocular granulomas in which the epithelioid and giant cells frequently contain pigment granules. There is diffuse lymphocytic and plasma-cell infiltration of the entire uveal tract. In the choroid this is particularly dense in the outer layers, whereas in the ciliary body it is the inner layers which are particularly involved. The retina shows lymphocytic periphlebitis but is comparatively uninvolved. There are inflammatory pupillary and cyclitic membranes. Serofibrinous exudate occupies the anterior chamber and there is serous exudate in the ciliary body, choroid, subretinal space, and vitreous chamber. The retina is detached.. The lens has undergone degenerative changes. Because of the uveal distribution of the granulomatous process, intraocularly, we believe this is a case of sympathetic ophthalmia in spite of the caseation and foreign-body reaction in the conjunctiva. We should, however, like to know the condition of this eye before iridencleisis and the present condition of the other eye."

SYMPATHETIC OPHTHALMITIS

DR. RALPH O. RYCHENER reported a case of sympathetic ophthalmitis following an injury to the right eye and resultant involvement of the left eye after 44 days. M. C., aged 27 years, struck in the right eye by a broken log chain on December 2, 1944, was attended by Dr. Stanford Herron, who removed the prolapsed iris and ciliary body and sutured the laceration of the sclera. Vision in the left eye remained 6/6 until the forty-fourth day following the injury, when the left eye began to be painful and the vision failed very suddenly.

The patient was seen in consultation on the forty-ninth day, when the visual acuity in the injured eye was 3/60 and in the sympathizing eye 1/60. Since it was possible that the injured eye might prove

ultimately to be the better eye, enucleation was delayed while active treatment with foreign protein in the form of diphtheria antitoxin, autohemotherapy, and local treatment was instituted. Recurrent anterior-chamber hemorrhages occurred in the right eye, and nine days later this eye was removed.

Pathologic examination disclosed incarceration of the ciliary processes and pigment in the scar of the penetrating wound at the limbus; the lymphocytic infiltration and foci of epithelioid cells indicative of sympathetic ophthalmia were present.

Despite saturation with sodium salicylate, extraction of infected teeth, and all other recommended forms of treatment, the left eye deteriorated to the plastic uveitis which is the end stage of sympathetic ophthalmia. The vision was perception of moving objects only, and the tension was 40 mm. Hg. (Schiøtz).

CYCLODIATHERMY

DR. RALPH O. RYCHENER reported a case of compensated glaucoma in a colored man treated with cyclodiathermy after previous iridectomy. W. A. W., aged 28 years, was seen September 29, 1943, with normal vision in each eye. The tension in the right eye was normal; in the left eye it varied from 48 to 56 mm. Hg (Schiøtz), with a typical glaucomatous field. The tension in the right eye was never recorded as greater than 30 mm. Hg, and the visual field in this eye was normal.

On January 28, 1944, following a congestive attack in the right eye which yielded to paracentesis, a broad-based iridectomy was performed. Despite miotics, the tension steadily rose to 48 mm., and on February 26th a cyclodiathermy with both the Weve tip and micropin was performed across the lower quadrant.

There was marked reaction, the eye became very soft, with much choroidal edema and hemorrhage into both the choroid and retina over the treated area. Visual acuity was reduced to perception of moving objects. Under the administration of atropine and "mixed treatment" internally, there was gradual recovery, and on January 8, 1945, the visual acuity was 20/25, tension was 13 mm., and the fundus was entirely free of hemorrhage and showed only a few chorioretinal scars over the affected area. It was apparent that in this case a lesser application of diathermy current would have produced a good result, since it is undesirable in such cases to induce an iridocyclitis of this degree.

KERATITIS SICCA

DR. RALPH O. RYCHENER reported on Mrs. W. W. B., aged 65 years, who was afflicted with arthritis deformans and complained of ocular discomfort and of burning and itching associated with a ropy conjunctival discharge for which she had received much local treatment without relief.

She was seen for the first time on September 11, 1942, at which time there was a diffuse staining of the cornea, with much epithelial debris adhering to the cornea. The Schirmer test showed a wetting of the filter paper of $2\frac{1}{2}$ mm. after five minutes. Locke's solution and holocaine ointment were prescribed, and the Beetham operation advised. This surgical advice was disregarded until June 4, 1943, when all four puncta were sealed off with an actual cautery, and Feldman's solution was prescribed.

There was instant relief of all symptoms and the patient's only complaint after a year was that her eyes were now too moist. It might seem advisable to perform further operations for this condition in two stages, sealing off the lower puncta first and repeating the procedure above if it seems necessary.

GLAUCOMA

DR. E. C. ELLETT reported a series of cases of glaucoma.

Case 1. Miss M. was seen in 1916, with chronic simple glaucoma. The vision was normal. The discs showed cupping and the visual fields were contracted. The vision failed some in that year and a Lagrange operation was performed on the left eye in November, 1916, and on the right eye in October, 1920. In December, 1944, 28 and 24 years after the operations, respectively, for left and right eyes, the tension was R.E. 19, L.E. 23 mm. Hg (Schiøtz). The visual fields showed some contraction but had remained stationary from 1934 to 1944. Cataracts developed and the lens was removed from the right eye in December, 1944, a combined intracapsular operation being done. The patient was feeble and senile, but the eye had done well.

Case 2. Mrs. J., aged 45 years, had been under observation since she was 9 years old. She wore the following correction: R.E. +5.50D. sph.; L.E. +4.50D. sph., with satisfactory results. In 1921 she had had an acute choroiditis in the right eye which healed with a pigmented scar above the macula. The vision was reduced to 20/40. In 1935 she had an attack of acute glaucoma in the right eye, for which a trephining with complete iridectomy was done. The tension remained very slightly elevated in the right eye. The vision was normal for distance, but defective for near, with an almost complete ring scotoma which included the blind spot. In November, 1944, vision with glasses was R.E. 6/7.5, partly; L.E. 6/6. There was cupping of the disc in the right eye. The left was normal. The tension was 35 mm. Hg (Schiøtz)

in each eye. Eserine did not control the tension, so mecholyl and prostigmine were used. The tension fell to 25 mm. in the right eye, but rose to 60 mm. in the left eye, with pain and some blurring of vision. The tension was relieved by pilocarpine, heat, and morphine, and in two days was 19 mm. The patient was advised to continue using pilocarpine.

Cases 3 and 4. J. R. and S. R., identical twins, aged 48 years, had been under observation for chronic glaucoma for several years.

J. R. was seen in 1916 for a soft movable tumor of the conjunctiva of the right eye. This was removed and reported as a hemangioma. The eyes were otherwise normal. In 1940 a diagnosis of glaucoma was made, and he was given treatment by a doctor in Texas. In 1942 the tension was R.E. 26, L.E. 22 mm. Hg (Schiøtz). In 1944 the vision was still normal, with correction for myopic astigmatism. The fundus was normal in each eye. The tension was 32 and 28 mm. The visual fields were normal.

S. R. was seen for the first time in 1931. He also had myopic astigmatism. He had had Buerger's disease for three years, but the eyes were normal. When seen in 1940 the right eye was normal. The left eye showed some lens opacities, a cupped disc, and the tension was 52 mm. In 1944 the left eye showed no change, but the tension of the right eye was 41 mm. The vision was normal in the right eye. In the left eye the cataract had matured, and the vision was reduced to light perception. Since there was a history of trauma to the left eye in childhood it was considered possible that there was a connection between this and the present condition, although in 1931 the vision had been normal, but there were some peripheral lens opacities. Operation was advised on the right eye.

Case 5. Mr. A. H., aged 60 years, was seen for the first time in 1937, when a diagnosis of glaucoma was made. The left eye had been weak as the result of a railroad accident in which he had suffered the loss of an arm and acquired the morphine habit. The corrected vision was 6/7.5 and 6/9. The fundi were normal. The tension was R.E. 24 mm., L.E. 19 mm. Hg (Schiøtz). Visual fields were normal. The condition remained about the same until March, 1944, when he had an acute attack of glaucoma in the right eye, with the tension 54 mm. Both irides were slightly atrophic. He would not permit a paracentesis to be performed. In October the right eye was operated on in another city. When seen in December he had a blind and painful eye, but it was impossible to tell what had been done. The left eye was quiet. The tension was 46 mm. There were many small keratitic precipitates on Descemet's membrane. The right eye was enucleated. Treatment with miotics, all of them except doryl, had not reduced the tension in the left eye, which remained around 50 mm. The eye was not painful, the fundus was normal, and vision was 6/12. The visual fields were almost normal. Repeated paracenteses gave only temporary reduction of tension. The iris showed some atrophy and visible vessels. The cornea had cleard somewhat, but was not free of precipitates. On January 6th, a cyclodiathermy with paracentesis was done. The lower half of the eye was treated with contact diathermy and current of 35, exactly as described by Drs. Albaugh and Dunphy. The tension on January 8th was 25 mm.

KERATOCONJUNCTIVITIS SICCA

DR. J. WESLEY MCKINNEY reported the case of Mrs. C. F., aged 39 years, who was seen on June 10, 1942. She complained of redness, burning, discharge,

and photophobia of several years' duration. For the preceding three months the vision had become so blurred at times that she could not read the newspaper. A complete physical examination revealed only a slightly lowered basal metabolic rate and a low-grade anemia. She had received many local treatments of silver nitrate and had taken vitamins, iron, and thyroid for an extended period of time. Examination revealed that the palpebral conjunctiva was red and thickened and had a ropy secretion. There was slight circumcorneal injection and epithelial keratitis with many filaments. The eyes were internally normal and the tension was normal. The vision was R.E. 20/50, L.E. 20/30, with correction. Schirmer test revealed the litmus paper to be wet only 3 mm. in 5 minutes. She was given Locke's solution which improved her condition partially, but she was still so uncomfortable that she readily accepted the suggestion for obliteration of the puncta. Consequently, all four puncta were obliterated by means of the diathermy needle. Relief was almost immediate. The conjunctiva and cornea rapidly returned to normal, the vision to 20/20 in each eye. She was able to read with comfort for the first time in several years.

CHRONIC BLEPHAROCONJUNCTIVITIS DUE TO LID WARTS

DR. J. WESLEY McKINNEY reported the case of Mr. A. M. E., aged 57 years, who was seen for the first time on October 12, 1942. He had received much local treatment for chronic blepharoconjunctivitis of the right eye, all the local medications having been applied without benefit until two small marginal lid warts were removed from the upper lid. Following the removal of the warts, the blepharoconjunctivitis cleared rapidly and there had been no return of the

condition. It is supposed that this conjunctivitis resulted from the virus infection associated with the warts.

UVEITIS WITH ALOPECIA, POLIOSIS, VITILIGO, AND DYSACOUSIA—REPORT OF TWO CASES

DR. G. K. KAMBARA, by invitation, said that Vogt first described the syndrome wherein uveitis was associated with alopecia, vitiligo, poliosis, and dysacousia in 1906. Later a larger series was reported by Koyanagi and Harada from Japan. Depigmentation of the lashes had been reported associated with iritis as far back as 1873 by Schenkl and in 1874 by Jacobi. Association with vitiligo was reported by Gilbert in 1910.

This disease occurs most frequently in the third decade of life. The uveitis is usually bilateral and of an exudative type. It is slowly progressive. The process seems to be self-limiting with good vision maintained in about 30 percent of the cases; however, more frequently, there is permanent loss of vision. The fundus picture is one of edematous retinitis and choroiditis.

The alopecia and the poliosis of hair, eyebrows, and lashes occur in 90 percent of the cases. Vitiligo and dysacousia occur in 50 percent. Occasionally there are signs of meningeal irritation.

Nothing definite is known as to the etiology. An endocrine origin was postulated by Koyanagi, but Duke-Elder thinks more of the toxic origin. Treatment is symptomatic. Any operative procedure is usually unsuccessful.

The two patients whose cases are reported below did not show dysacousia. Both did complain of arthritis, however.

Case 1. A colored woman, aged 36 years, was seen for the first time in the Eye Clinic of the Memphis E.E.N.T. Hospital on May 23, 1943. She com-

plained of a painful left eye since having a tooth extracted in September, 1942. The vision was R.E. 20/20−2, L.E. 20/65. Examination revealed keratitic precipitates and posterior synechiae. A diagnosis of acute iritis was made, and heat and atropine were prescribed. Two milk injections were given, with some improvement of the patient. One month later papillitis was noted in the left eye. Kline test was negative. On August 18, 1943, a tonsillectomy was performed because of recurring sore throats and earache of several weeks' duration. From July to November the patient did not return to the Eye Clinic. When she did return she had seclusion and occlusion of both pupils but no iris bombé. There were still ciliary injection and many keratitic precipitates. Tuberculin tests of 1:10 and 1:100 dilution were negative. She complained of pain in her knees. Another general medical examination was advised. In December, 1943, tuberculin treatment was started with 1 mm. of 1:100,000 tuberculin. A course of typhoid antigen starting with 10 million organisms was also given for five doses. No appreciable improvement was noted. An iridectomy was performed with difficulty on January 28, 1944. The iris was very adherent and atrophic. In one month's time the iridectomy area was covered again. Tuberculin treatment was again instituted, starting this time with 1:2,000 dilution. In April, a course of X-ray treatments was given to both eyes at the John Gaston Hospital. Following this the eyes were more painful. In May there were numerous nodules on the iris and hypopyon was also present. By July, 1944, more and more new vessels were appearing on the iris, hypopyon was still present, and the patient showed local reaction to the tuberculin. The tuberculin was discontinued.

In August, 1944, she had the remaining teeth extracted and felt improved. When she returned in October she showed depigmentation around the lids. The lashes had turned gray. She had developed alopecia and poliosis in the hair of the parietal region. The cornea of the right eye had turned opaque. Her condition was shown on slides.

Case 2. A Japanese woman, aged 46 years, was seen in the Tule Lake WRA Hospital in September with a complaint of painful eyes for several months. Examination at that time revealed ciliary injection, keratitic precipitates, and areas of posterior synechiae. Attempts at dilatation of the pupil with adrenalin and atropine were not very successful. She was given a course of typhoid-"H"-antigen foreign-protein therapy with only slight improvement. While in the Hospital she complained of headaches, and joint pains as well as ocular pains. All her teeth were extracted. With each extraction she suffered a flare-up in her eyes. Sulfadiazine by mouth was given for about two days, without appreciable effect. The synechiae increased until she had total seclusion and occlusion. Several weeks after the typhoid treatments, her hair started to fall out in spots and the remaining hair became gray and coarse. She was seen by an ophthalmologist from Stanford University and Klamath Falls on different occasions. A second course of typhoid was given about two months later. A few months later vitiligo was noted around the neck and face. Then still later her lashes started to turn white. During the time under observation from September, 1942, until June, 1943, her eyes became progressively worse. She had pain and ciliary injection when last seen. She had no hearing impairment. Wassermann and tuberculin tests were negative.

DR. HAESSLER EDITS THE ABSTRACT DEPARTMENT

The Abstract Department of the American Journal of Ophthalmology has occupied a distinctive position in the journalism of the specialty. The Germans were pioneers in the attempt to present to their readers a comprehensive summary of the periodical literature of ophthalmology. Other abstract departments than that of Theodore Axenfeld in the Klinische Monatsblätter für Augenheilkunde and that presented by the American Journal of Ophthalmology for the past nineteen years have usually made very little pretense at completeness, and most of them have represented simply a sort of space "filler."

More systematic annual review of the periodical literature of ophthalmology was attempted in the German Jahresbericht, whose date of publication was, however, usually a year or two behind the original dates of publication of the material which it surveyed.

Edward Jackson undertook, at first inadequately, later more comprehensively, to gather the world's ophthalmic literature in a single publication, the Ophthalmic Year Book, appearing soon after pub-

lication of the original material. When, in 1926, on account of financial and other difficulties encountered, Jackson decided that it was necessary to discontinue the Ophthalmic Year Book, the present writer proposed an attempt to furnish a fairly sufficient substitute for the Year Book in the form of an abstract department which should at least approach completeness of presentation of the world's current ophthalmic literature.

There can hardly be any question that such a department is of value to the general reader, and of much greater value to those who have occasion to carry on literary research; although it must be acknowledged that many subscribers to medical periodicals find little time for thorough reading.

Successive labors on the Ophthalmic Year Book, on the general editorship of the Journal, and in the conduct of the Abstract Department have occupied a substantial share of the present writer's time for the past thirty-five years. Such tasks bring many rewards in the sense of service to the profession, in contact with the best of the world's medical literature, and in delightful and stimulating personal associations. But it does not seem unreasonable to seek leisure in the evening time of life. The writer, therefore, with mingled regret and satisfaction, yields the editorship of the Abstract Department to other hands. Beginning with the current issue, the Department will be edited by Dr. F. Herbert Haessler, who was a collaborator on the Ophthalmic Year Book and who for many years has furnished some of the best material of the Abstract Department. The present writer, who greatly values Dr. Haessler's willingness to devote himself to this task, wishes him success, and at the same time cordially thanks the many willing helpers who by their labors have made the Abstract

Department possible.

(The writer feels that this message to our readers would not be complete without sincere acknowledgment of the earnest and capable service rendered in this work for many years by his secretary, Miss Grace M. Carter.)

W. H. Crisp.

AMERICAN OPHTHALMOLOGICAL SOCIETY MEETING.

The eighty-first annual meeting of the American Ophthalmological Society was held on November 12th, 13th, 14th at the Homestead, Hot Springs, Virginia. This is an unusual time of year for this meeting which is regularly held at the end of May or the first part of June each year. It had, however, been voted to omit the 1945 gathering because of the war. With the cessation of hostilities the Council decided to hold a belated meeting because of papers previously prepared and in order not to interrupt annual meetings which had been held every year for 80 years.

There was question in the minds of the officers as to the likelihood of good attendance, owing to the relatively unfavorable time of year and the difficulties of transportation. Much to their surprise, however, the gathering was the largest this Society has ever held. The weather, too, smiled on the meeting and the first two days were warm and sunshiny. The third day, however, was raining and ended in light snow.

First, of course, should be mentioned the scientific program, not only because, however pleasant the social aspects, the primary purpose of this Society is now and always has been scientific. From its meeting have emanated many outstanding contributions to ophthalmology. This meeting was no exception. In fact, many of the

members and guests stated that it was one of the best programs that they had ever heard. Space will not permit more than mention of a few of the subjects discussed. But a word might be said about some especially interesting items.

No one could ask for a clearer exposition of some physiologic factors in the differential diagnosis in the superior rectus and superior oblique paralyses than that given by Adler. The illustrations and diagrams were almost sufficient without the clear discussion by the author. Bedell showed beautiful colored photographs of retinal proliferation in diabetes. The listener can always count on seeing the most beautiful examples of fundus photography whenever Dr. Bedell presents a paper of which the subject can be so illustrated. Ruedemann showed examples from a series of over 100 plastic eye implants in all types of sockets. The prosthesis is placed inside of the muscle cone and the recti muscles are attached to it through appropriately placed holes in the material. Undue reaction does not follow the operation and obviously splendid motion is obtained. Surprisingly the conjunctiva takes care of itself satisfactorily without suturing to the acrylic implant. The technique is difficult and probably improvements will be found. But the procedure seems worthy of careful study. Samuels presented beautiful slides of pathologic eyes illustrating cataract and intraocular tumors. His specimens were, as usual, always of the highest order.

Beautiful illustrations of keratoplasty were shown by Castroviejo, and a catalogue of suitable types for this procedure and those better suited to keratectomy were outlined. This classification should be useful to those whose experience is limited.

Gundersen, one of the few members still in service, presented evidence from

19 Vossius rings that the iris margin has nothing to do with their formation, their size being practically the same irrespective of the hour of day or night that the injury took place. He thought also that the deposit could scarcely be due to attached iris pigment and likened it further to the central disc seen in capsular exfoliation and somewhat similar to arrangements of deposits in the anterior capsule in chronic intraocular inflammation. In general, his conclusion was that some fundamental characteristics of the lens capsule were probably responsible for the formation of the ring.

Kirby made some important points regarding ptosis and pseudoptosis. His talk indicated the necessity of careful differentiation between the two as a preliminary to possible surgery and a knowledge of whether the superior rectus was truly paralyzed or not.

Berens showed interesting statistics on the relative value of nylon, plain and chromic catgut, and silk, especially as concerned the coefficient of friction, postoperative reaction, and rate of absorption.

The meeting introduced two departures from custom, though not entirely unique features; namely, a reception for new members on the second day of the meeting followed by a banquet in honor of Dr. Vail, recently Colonel in the Medical Corps of the U. S. Army, Senior Consultant in Ophthalmology in the European theater, and Chief Consultant in Ophthalmology to the Surgeon General. The dinner was also in honor of Prof. Ida Mann of the Eye Hospital, Oxford, England, who has been visiting this country to study the eye institutions with a view to incorporating useful ideas into the construction of new eye hospital at Oxford and rebuilding the badly damaged structure at Moorfields. The presence of

Professor Mann with her equally delightful husband, Professor Gye, and her description of some phases of English ophthalmology at the dinner added much to the pleasure of the meeting. Dr. Vail gave a very interesting talk on his war experiences in ophthalmology. Among the most enjoyable features of the banquet were the delightful remarks of Dr. Beech, the President of the Society. His keen humor did much to enliven the evening.

Dr. Eugene M. Blake was elected president for the ensuing year and Dr. John W. Burke vice-president. Dr. John A. MacMillan was appointed the new council member and The Homestead chosen for the spring meeting unless the American Medical Association meets in the West, in which case plans may be changed to avoid unnecessary travel for those who desire to attend both meetings.

Lawrence T. Post.

THE NEED FOR MORE BASIC COURSES IN OPHTHALMOLOGY

The reëstablishment of the basic course in ophthalmology at Northwestern University Medical School serves to call to our attention the crying need for the establishment of more similar courses as a precursor of residencies in ophthalmology. At the present time there are only three other courses of this type available: the one at the University of Pennsylvania, which is the oldest, one at Washington University in Saint Louis, and the one given by New York University.

The war has shown the need for more well-trained ophthalmologists in this country. From the number of applications received from returning veterans who are desirous of obtaining an adequate training in ophthalmology it is obvious that the needs can be filled if the training facilities are made available. At the present time the opportunities are quite inadequate.

A three- or four-year residency in a well-established division of ophthalmology in one of the large university medical schools is probably the ideal way of obtaining a training in ophthalmology. Here, as part of the training, the basic sciences are taught by lecture and laboratory work. Here also are opportunities for work in the anatomy, special pathology, bacteriology, and research laboratories. The unusual library facilities also encourage study of the rare and most recently reported conditions. The association with the teachers of other branches of medicine tends to broaden the outlook and increase the knowledge of the relationship of other branches of medicine and ophthalmology. These opportunities are limited, as the number of residencies of this type is small. From this group must come our teachers, our research men, pathologists, and consultants. It is from this group that the teachers of the basic courses of shorter duration must also be obtained.

As already stated, the number of these regular residencies is entirely inadequate and not sufficient to fill the needs of the specialty. There are, however, many hospitals, especially larger county hospitals away from medical-school centers, that have competent clinical ophthalmologists who could and do teach clinical ophthalmology well. These men often have neither the time, inclination, background, nor the facilities properly to teach the basic sciences. For residents in such appointments the basic-science course as given by the four above-mentioned institutions is not only advisable but essential in the development of a "safe ophthalmologist." In these courses, of from 6 to 8 months' duration, the time is devoted to lectures, laboratory, and

clinical demonstrations. Thus in a relatively short time the foundation is laid for the future development of a dependable ophthalmologist. From personal observation it is apparent that the men who have followed up such a course with a year or two in some institution or clinic have done very well. It should be pointed out that this year of basic training must be followed by carefully supervised clinical work.

Unfortunately, because of the facilities required for such courses, the number of places available in these four established courses is limited and not sufficient to fill the needs. From the foregoing it is apparent that other facilities must be provided to make available to more men the proper teaching in the basic sciences of ophthalmology, which while not ideal would train them sufficiently well to qualify them for their American Board of Ophthalmology examinations; in other words, qualify them to be "safe ophthalmologists."

While less ideal than these methods of training the one suggested by Gradle warrants serious consideration. Gradle's suggestion is that a three-months' concentrated course in the basic sciences be given in a number of centers immediately following the general-interne year, and that the residencies start in October; that is, after the three-months' course. It would probably be advisable for a committee, perhaps representing the three major eye societies, to work out a uniform course of instruction that would cover the essential subjects and outline the methods of teaching to be used. This would permit the resident to devote three months to concentrated study without the care and responsibilities of a clinic, a great help if the resident had an appointment in an institution where one resident must shoulder the entire responsibility. In ad-

dition, the basic course would give him sufficient foundation to be of some help to the institution from the start. It would also have the tendency to encourage more institutions to resume the responsibility for the clinical training of men.

Training can also be obtained through preceptorship and association in private practice with a well-qualified and well-trained ophthalmologist. Here, especially, it is essential that the individual obtain his basic course before starting in practice, as the pressure of private practice is not conducive to theoretical instruction from the preceptor. However, having had the basic course and following it up with carefully planned reading, such as the Home Study Course of the American Academy of Ophthalmology and Otolaryngology, the young ophthalmologist is assured proper guidance in training.

It is hoped that American ophthalmologists, both teachers and clinicians, realize their responsibility and duty in the training of ophthalmologists and that more institutions establish basic courses as a precursor of residencies in ophthalmology. Frederick C. Cordes.

BOOK NOTICE

ÉLÉMENTS DE GONIOSCOPIE NORMALE, PATHOLOGIQUE ET EXPÉRIMENTALE. By Archimede Busacca. Stiff paper covers, 200 pages, 81 illustrations including four plates, one in color. São Paulo, Brazil, Tipografia Rossolillo, 1945. Price not stated.

This book is an excellent statement of the author's personal study of the subject and of his conclusions; as well as a discussion of his own views and those of other writers with regard to many points in anatomy and diagnosis with regard to which differences of opinion exist. The

author suggests that, in the region dealt with, small differences of relief are of great importance, so that the region can be studied efficiently only by means of stereoscopic vision, the best conditions for examination being afforded when one applies to the study of the iridocorneal angle biomicroscopy as it is currently practiced for other parts of the eye. So keen were Salzmann's powers of observation, that Busacca believes other ophthalmologists, although provided with more perfect apparatus, have added little to Salzmann's observations as published in 1915, those observations having been made with the ophthalmoscope. The most satisfactory recent device for study of the chamber angle is that of Goldmann (American Journal of Ophthalmology, 1939, volume 32, page 444), who devised a contact glass furnished with a mirror in which the image of the angle is reflected.

A preliminary chapter on the technique of examination, using the Goldmann appliance, is followed by a chapter of general anatomic data on the chamber angle, and exhaustive chapters on the normal and pathologic angle.

In the chapter dealing with the pathologic angle, details dealt with include modifications of the angle following inflammatory processes of the uvea; gonioscopic aspects after operative interventions (iridectomy, cyclodialysis, incarceration of the iris); gonioscopy in diseases of the cornea; gonioscopic modifications in dislocation of the lens, in congenital deformities of the iris, and in glaucoma of various types. A note is added on the zonule and the ciliary processes in gonioscopy.

A final chapter describes chiefly the author's personal experiments as to the modifications produced by atropine and eserine in the region of the chamber angle, particularly as regards the behavior of the ciliary body in iridectomized eyes. (Bibliography, 88 case records, index.)

W. H. Crisp.

CORRESPONDENCE

CONTINENTAL OPHTHALMOLOGISTS NEED OPHTHALMIC LITERATURE

Editor,
American Journal of Ophthalmology:

Since 1941, American publications have not been available to most of the Continental centers and investigators. I have had several letters from ophthalmologists abroad indicating the desire and need for ophthalmic literature which has appeared during these war years.

It occurred to me that some subscribers of the American Journal of Ophthalmology with copies for the past several years would be willing to send their copies abroad to ophthalmic centers or individuals. If such subscribers would write to the Howe Library of Ophthalmology, c/o Miss Jeanette Loessel, 243 Charles Street, Boston 14, Massachusetts, a name and address will be provided to which the American Journal may be sent. Arrangements are being made to reimburse the donors for the cost of mailing.

David G. Cogan, M.D.

ABSTRACT DEPARTMENT

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

5

CONJUNCTIVA

Kadlicky, Roman. **The chemotherapy of pyogenous conjunctivitis.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 136-137.

Use of a sulfonamide (Dipron, which is 4 Aminobenzensulfonamide) by mouth has not only simplified the treatment of gonorrheal conjunctivitis of the new-born and adults, but is far superior to any previous method of treatment.   F. Herbert Haessler.

Lewis, G. G. **Ophthalmia neonatorum.** Med. Record, 1945, v. 158, June, p. 351.

The author stresses the importance of ophthalmia-neonatorum blindness. In institutions 30 per cent of the blind had this condition. The organism involved may be gonococcus, pneumococcus, Koch-Weeks bacillus, staphylococcus aureus, bacillus coli, or other organism. The disease can invariably be prevented if proper prophylaxis is observed, and readily cured if early and proper treatment is instituted. Any person engaged in midwifery should be strictly accountable for the proper care of the baby's eyes after delivery. The author gives his method of treatment, including frequent irrigation, silver-nitrate solution and, absolute cleanliness.   Robert N. Shaffer.

Melik-Musian, B. N. **The intravenous, subconjunctival, intramuscular, and subcutaneous use of sulfidine in trachoma.** Viestnik Oft., 1944, v. 23, pt. 6, p. 29.

On the basis of treatment of three hundred cases, intravenous administration has proved the most effective. Subconjunctival use proved too irritating and had to be abandoned. Intramuscular or subcutaneous administration works much more slowly, and is only used when intravenous administration is not practicable. Half-percent solutions, administered twice daily at an interval of 4 to 5 hours, 10 c.c. for the adult and 5 c.c. for the child, have been found adequate. In the presence of diplobacilli, zinc sulphate is used in ad-

dition, and follicles when massive are expressed. The results surpass those of all other treatments. A pannus crassus melts away under the method. Only five of the cases returned with relapses. The treatment is given during one month, at most. Usually patients are discharged cured in 20 to 25 days.

M. Davidson.

Volokitenko, A. E. **The streptocide treatment of trachoma.** Viestnik Oft., 1944, v. 23, pt. 6, p. 32.

Complete cure was achieved in 60 percent of the thirty cases treated and improvement in the rest. Half of them had been in existence more than 2½ years, and all stages were represented. In some cases the effect was not noted immediately. Internal administration of 1 to 1.5 gm. per day was found adequate. Neither larger dosage nor addition of local use of the drug was found of any advantage. Effects were noticeable in less than two weeks.

M. Davidson.

Wolter, Friedrich. **The occurrence of epidemic ophthalmia (kerato conjunctivitis nummularis epidemica) in Germany since 1938.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 113-135.

In this 25-page analysis of epidemics of ophthalmia the author emphasizes the mode of occurrence of epidemics in order to clarify the factors that bring them about. Though he briefly describes the manifestations of the epidemics of eye disease which recently occurred in Germany and which seem to be identical with the shipyard epidemics in America, the theme of his work is the study of the process of epidemic morbidification. The epidemic of ophthalmia which occurred in Egypt in the period from 1798 to 1801 is particularly illuminating. The analysis of this and other epidemics, the manifestations of which are well recorded, strengthens Wolter in his adherence to a view which he has previously published—namely that the epidemiologic concepts of Pettenkofer on the one hand and of Pasteur and Koch on the other are not irreconciliably antithetic. The older writer derived epidemic diseases from miasmatic, telluric, and meteorologic factors. The gaseous exhalations from the earth necessarily bound the epidemic to a certain area at a certain time. Careful analysis of the records of epidemics seems to confirm this belief. Ophthalmias that went through regiments of soldiers in Italy, for example, immediately ceased when the soldiers were transferred to France. The modern view ascribes the spread of the epidemic disease to the spread of the causative virus or bacterium. Nevertheless the facts that emerge from the study of the records of epidemics cannot be denied and the author emphasizes the importance of the study of the many neglected factors which are necessary to bring about dissemination of the immediate causative agent. Since the advent of the bacteriologic era only the latter has been considered, to the entire neglect of other indispensable factors which in prebacteriologic times were called miasma or contagium. (Bibliography.)

F. Herbert Haessler.

6

CORNEA AND SCLERA

Chernikova, T. V. **Sulfazol treatment of corneal ulcers.** Viestnik Oft., 1944, v. 23, pt. 6, p. 25.

Good results are reported from use of a 5-percent sulfazol ointment in 80 cases, among them 32 of ulcus serpens. Secondary iritis was noted in many and

is attributed to the toxic effect of the drug.   M. Davidson.

Czukrász, Ida. **Scleral defects and their treatment.** Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 245-257.

, A report of 14 cases of defects of the sclera, operated upon according to the author's previously described procedure, namely covering the defect with combined conjunctival and Tenon's-capsule flaps. Nine cases were traumatic, two tuberculous, and three had developed scleral necrosis after Blascovics' strabismus operation (myectomy). (References.)   F. Nelson.

Friede, Reinhard. **Causes, prevention, and treatment of opacities in keratoplastic grafts.** Klin. M. f. Augenh., 1941, v. 107, Nov., pp. 480-506.

The eyes of receiver and donor need careful preparation before transplantation. Tissue vitality has to be increased. The metabolism of the cornea needs improvement. The operation has to be performed with as little damage as possible to corneal tissue. Differences in thickness between the donor's and the receiver's cornea should be avoided. The graft should not be placed in any kind of fluid that could cause swelling of the tissue. If the anterior chamber of the receiver is shallow all remnants of exudate and blood should be removed, since their presence would lead to undesirable membrane formation. Grafts should be secured by cross sutures in every case.

To keep the graft from becoming opaque the author recommends the following rules: Abnormal swelling of the tissue should be treated before operation. Only donor eyes with normal osmotic pressure of the corneal parenchyma should be used. Epithelium and endothelium should be normal in function. Grafts from eyes suffering from chronic or acute uveitis should not be used if other material is available. The graft, after being placed in the receiver's eye, needs attention and treatment at once, and carried through from two to three weeks. Even if the operated eye shows no irritation, prophylactic treatment of the patient, especially with foreign-protein injections, should start immediately in order to avoid irritation and exudation in the anterior segment of the eye. The author declares most emphatically that local and internal dehydration is of greatest importance to prevent undesired swelling of the corneal tissue and to increase the healing tendency. If shortly after transplantation the graft tends to become cloudy, Friede uses highly hypertonic solutions locally. Highly concentrated dextrose and leucose solutions are useful, but undissolved powdered sugar, put directly on the cornea and in the conjunctival sac, is even more effective. The author reports three cases of total corneal leucoma, operated upon successfully. The grafts became cloudy but cleared up again after general dehydration and local sugar applications. (7 figures.)   F. Nelson.

Henderson, J. W., and Gillespie, D. R. **Unusual type of corneal opacities.** Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1236-1244.

Hofe, K. vom. **Clinical contribution to the understanding of keratitis neuroparalytica.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 154-159.

Hofe describes the clinical course of corneal lesions in six patients in whom the Gasserian ganglion had been destroyed by electrocoagulation. Behr has described two forms of corneal dis-

turbance, namely central loss of epithelium in a round central area that heals with a dense scar and more extensive but also more benign punctate epithelial destructoin which involves the entire corneal surface or at least its lower portion. In the author's patients both of the lesions occurred in the same eye at different times, and contrary to Behr's experience recurrences were not uncommon. Though the theory of trophoneurotic origin of these lesions has much support the author points out that in three of his patients the lesion followed trauma. In one of them there was evidence of physical trauma to the anesthetic eye, of which the patient was unaware. In the other two a loss of transparency of the epithelium such as is associated with chemical burns followed exposure to cold in one and contact with a drop of dilute alcohol in the other. (1 figure.)

F. Herbert Haessler.

Imre, Josef. **Clinical and histologic experience with corneal grafts.** Klin. M. f. Augenh., 1942, Supplement 14, 50 pp.

To aid colleagues who have little practice in corneal grafting, Imre exhibits his accumulated experience. In the first 16 pages he describes in detail his operative procedure. He uses only grafts of living cornea, obtained by trephining from an eye just enucleated. The disc of clear cornea is inserted into a circular hole in the eye of the host, made by means of a Hippel automatic trephine. A safety collar surrounds the blade 1 mm. above the cutting edge. Only once has the writer injured a lens. The graft is immediately fitted into the opening, and a previously prepared conjunctival flap is sutured over the entire cornea.

In the remaining 34 pages Imre dis-

cusses his results. Of 98 eyes operated upon, the graft remained translucent in 56, and the visual acuity was improved in 42. In 31 cases the operation was performed on eyes such as are usually considered unsuitable for the operation, yet even so the statistics are encouraging. More than 20 eyes are discussed in detail and with colored photographs and some histologic illustrations. The beginner is advised to do his first few transplants on hopelessly defective eyes. (1 table, 64 illustrations, several in color.)   F. Herbert Haessler.

Krasnov, M. L. **Albucid treatment of hypopyon keratitis.** Viestnik Oft., 1944, v. 23, pt. 6, p. 22.

A 30-percent aqueous solution or ointment has proved the best means of treatment of hypopyon keratitis. A ten-percent solution was not effective, nor was the stronger solution effective in scrofulous or herpetic ulcer. Frequent instillation is important, intravenous urotropine enhances the effect, and use of atropine locally is necessary. No case required surgical intervention, none went on to perforation, and only fine nebulae remained. M. Davidson.

Miklós, A. **Treatment of serpent ulcer by means of total covering with a conjunctival flap.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 138-154.

In the early stages of rather benign forms of serpent ulcer, energetic conservative treatment often brings about healing. In more serious forms none of the usual heroic methods of treatment —steam cauterization, trephine, paracentesis, splitting the base of the ulcer —has given so satisfactory results as conjunctival covering. Partial covering is inadequate, presumably because the adhesion between the entire ulcerated area and the conjunctival tissue de-

velops too slowly. Total covering is easily accomplished and should be preceded by curettement of the ulcer. It can be done in ambulatory patients. The author uses the technique described in the surgical treatise by Blaskovics and Kreiker. When healing is complete the adherent conjunctiva can be dissected from the cornea without difficulty. Results are most satisfactory. (13 illustrations, references.)
F. Herbert Haessler.

Radnót, Magda. **The occurrence of corneal epithelium in the interior of the globe after ulcerous destruction in the cornea.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 147-154.

The author describes histologic preparations from two eyes in which the epithelium had proliferated into the interior. The cause was not accidental or surgical trauma but ulcerative destruction of corneal tissue—a condition which has been rarely noticed before. In one of these eyes keratomalacia with destruction of the cornea was followed by iris prolapse and fistula. The corneal epithelium proliferated on the surface of the granulated tissue. In the other eye an epithelial cyst and an island of epithelial tissue developed within the eye after perforation resulting from gonorrheal inflammation in a new-born infant. The newly formed intraocular masses of epithelial tissue are separated from the cornea and iris by cicatricial tissue. (7 illustrations, references.)   F. Herbert Haessler.

Salzer, Fritz. **How do corneal defects become regenerated?** Klin. M. f. Augenh., 1941, v. 107, Oct., pp. 389-404.

A critical survey of the results of studies in comparative histology and embryology, as well as of tissue cultures, which all point in the same direc-

tion, makes it highly probable that the cornea is epithelial in origin, development, and regeneration. It must still be decided whether new corneal cells can be grown from stromal explants, remembering that differences in behavior of corneal cells may occur when they are stimulated in the explant by culture medium, embryonal juice or other trephone, and that in life they may remain passive because the epithelium does all that is necessary. Certainly there are no reasons for believing that a two-weeks-old mass which fills a corneal defect with cells morphologically and tinctorially indistinguishable from epithelial cells will be replaced later by proliferation of corneal cells. If contrary to expectation this should occur it would only show that in corneal regeneration all embryonic layers function together in an integrally organized process but that the epithelial functions are decisive in the pattern. (7 figures, bibliography.)   F. Herbert Haessler.

Sato, Tutomu. **Surgical method for keratoconus treatment (splitting of Descemet's membrane.)** Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 234-238.

A special very small knife, curved at the end, is introduced into the anterior chamber through the limbus at the three and nine o'clock positions respectively, and Descemet's membrane as well as a good deal of the corneal parenchyma is incised from the rear in the horizontal meridian across the area of highest elevation of the keratoconus. The incision should be 3 to 5 mm. long. In case only a little of the corneal stroma is cut, one or two more cuts may be made parallel to the first one. Should the cornea be perforated during the operation, atropine is used in order to avoid anterior synechia. Otherwise

eserine is instilled. Immediately after the operation the internal corneal wound appears as a spindle-shaped cleft. The next day the vicinity of the wound is cloudy, and the stroma is swollen. Subsequently the thickness of the conical area of the cornea increases, and in the course of two or three months the conical shape disappears more or less, and the curvature approaches normal. Twenty-four eyes were operated upon, mostly with good results as to vision and shape of cornea. In many cases the myopia decreased considerably. (1 table, 6 figures.)

F. Nelson.

Schlichting, Hans. **Vesicular endothelial dystrophy of the cornea.** Klin. M. f. Augenh., 1941, v. 107, Oct., pp. 425-435.

After a review of the literature on degenerative lesions of the posterior surface of the cornea, the author describes an observation of his own which concerns two cases of bilateral endothelial corneal dystrophy in father and daughter. The lesion involved the central area of the posterior corneal surfaces and consisted of round and oval vesicles and depressions of varying size. It is possible that the depressions were the end result of vesicles which protruded into the anterior chamber and had ruptured. The normal markings seen in specular reflection were partially obscured in the areas between the vesicles. Ophthalmometer readings suggested keratoconus, and certainly the myopia was corneal in origin because, when a contact glass with a curvature equal to that of the normal cornea was applied, retinoscopy revealed one diopter of hypermetropia. The difference between this lesion and similar ones recorded in the literature leads the author to conclude that this is a new

and unique observation. (2 figures, bibliography.) F. Herbert Haessler.

Zwiling, M. D. **Scleromalacia perforans.** Viestnik Oft., 1944, v. 23, pt. 4, p. 36.

A case is reported accompanied by arthritis and macular degeneration, and located near the limbus, with atrophy of an adjacent iris sector, and cystic degeneration of the 7 by 3 mm. formation. M. Davidson.

7
UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Bulach, K. O. **The problem of early diagnosis of an "exciting" iridocyclitis.** Viestnik Oft., 1944, v. 23, pt. 6, p. 7.

The problem of potentially "exciting" uveitis in wartime is important. While 97 to 98 percent of enucleated eyes do not show the specific pathology suspected, the possibility alone justifies enucleation. With the object of verifying the studies of Rabinovich, which indicated the possibility of making an early diagnosis of the specificity of the uveitis by increase of blood monocytes, blood studies were made on 120 persons in whom one eye had been enucleated because of perforating injury. Only three showed specific pathology. The conclusion arrived at is that monocytosis is related to the acuteness and severity of the inflammatory process of the uvea rather than to its specificity. M. Davidson.

Friedman, S. J. **The prophylaxis, diagnosis, and treatment of sympathetic ophthalmia in the light of further observations.** Viestnik Oft., 1944, v. 23, pt. 5, p. 37.

Without a clear concept of its

genesis we have been handicapped in prevention and treatment of sympathetic ophthalmia. Until now we have been preoccupied with the mode of transmission from eye to eye and with the nature of the pathogenic agent. There is evidence in favor of a meningitic process mediating between the exciting eye and the sympathizing eye, and of the ocular affection not being limited to the eyes. The meningitic process is of the serous basal type with meager symptomatology, and the sympathetic ophthalmia responds to the same treatment to which basal meningitis responds, namely, spinal punctures. These therefore are indicated in all uveitides, and in the prevention of sympathetic ophthalmia. Two cases additional to those previously observed are reported in detail. Further arguments in favor of the relation between the meningitic process and sympathetic ophthalmia are advanced. The 2 or 3-weeks interval between the appearance of the process in one eye and its appearance in the other is similar to that observed in development of uveitis secondary to a virus in basal meningitis. The development of sympathetic ophthalmia after enucleation, sometimes 2 to 3 months later, and at times years later, argues for localization of the infectious process at the base of the brain. The occasional observation of optic neuritis in sympathetic ophthalmia is also in favor of a chiasmatic arachnoiditis. Both sympathetic ophthalmia and meningitis are more common in children, and the fact of sympathetic ophthalmia not being reproducible experimentally also speaks in favor of the belief. So far however no specificity of the spinal-fluid picture or specificity of the blood picture has been determined, nor has any marked difference in the blood picture after enucleation or evisceration been observed. But sufficient observations have been made to justify careful neurologic study of all sympathetic ophthalmia cases, and the addition to local therapy, in perforating injuries, of treatment directed to the meningitic process namely, repeated lumbar puncture, intravenous urotropine, and glucose and salt solutions. Evisceration should only be done in cases of panophthalmitis. Operations for traumatic cataract should not be done too early. Patients with perforating eye injuries should not be discharged as cured until there is normal spinal fluid and normal hematology. M. Davidson.

Krückmann, J. **Choroiditis guttata (Tay) and honeycomb choroiditis (Doyne).** Klin. M. f. Augenh., 1941 v. 107, Oct., pp. 361-372.

There is a certain similarity in the ophthalmoscopic pictures of these two entities. In both there are small yellowish-gray, almost punctate, opacities in the area about the macula. In choroiditis guttata the lesions are round, sharply defined, and more definitely yellowish, sometimes with a delicate pigment border. In honeycomb choroiditis they are polygonal (so as to suggest a honeycomb when they are closely packed), are more gray, much larger, and less sharply defined at their margins. In both, the normal retinal vessels pass undisturbed over the deeply placed opacities. Equal involvement of both eyes is an essential characteristic. Choroiditis guttata begins late in life, occurs preponderantly in females, may be familial, and is associated with normal vision, dark adaptation, and visual fields. It is probably produced by a drusen-like excrescence of the lamina vitrea and has no choroidal lesions, hence Dimmer prefers to call it retinitis

guttata. In Doyne's honeycomb choroiditis there is almost always considerable loss of vision, and in cases which were observed for a long time there was a paracentral scotoma connected with the blind spot, as well as disturbances of light and color sense. In the only case which has been available for microscopic study Treacher Collins found hyaline degeneration of the lamina vitrea and over these areas of degeneration there was destruction of the pigment epithelium and neuro-epithelium.

Since the etiology is unknown it has been impossible to correctly classify all reported cases in the literature, and there is much confusion. The author reports the five cases observed at the Munich Clinic. Two of them seem to belong to one group and three to the other. Those disturbances in an individual patient which do not seem to be part of the textbook picture of one or the other of these entities are readily explained on the basis of concurrent pathologic changes. (3 figures, references.)   F. Herbert Haessler.

Roberts, W. L., and Nielsen, R. F. **Uveoparotid fever with bilateral papilledema.** Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1252-1255. (References.)

Vila-Coro, Antonio. **Notes on the treatment of tuberculous iritis.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 172-179.

It is important to be conservative in the diagnosis of tuberculous iritis. Though the typical textbook picture of iritis is rare, patients in whom it occurs respond satisfactorily to specific therapy. On the other hand, when iritis is erroneously diagnosed as tuberculous on insufficient evidence the therapeutic results are disappointing and the value

of perfectly reliable therapeutic agents are misjudged. Once the diagnosis is reliably made tuberculin and calcium therapy are indicated. If they are ineffectual, sanocrysin in small doses should be used cautiously. The diet should be carefully supervised to guard against excess weight. In all resistant cases roentgenotherapy is indicated.
          F. Herbert Haessler.

8

GLAUCOMA AND OCULAR TENSION

Barkan, Otto. **Goniotomy. Preliminary deepening of the anterior chamber with air or saline solution.** Amer. Jour. Ophth., 1945, v. 28, Oct., pp. 1133-1134. (References.)

Carreras Durán, Buenaventura. **Modern orientation in the treatment of glaucoma,** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, July-Aug., pp. 631-714.

This is an exhaustive treatise on the care of glaucoma. The pathologic background, mode of action, and indications for employment of the various forms of medical and surgical treatment are thoroughly discussed.
          J. Wesley McKinney.

Casanovas, J. **Roentgen irradiation of the cervical sympathetic in treatment of glaucoma.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, July-Aug., pp. 594-607.

Ten cases of glaucoma were treated by irradiation of the superior cervical sympathetic ganglion. In some of them the tension was completely normalized, while in most of them the tension was lowered and the visual acuity and field improved. Pain was relieved in several cases. The procedure has some value

as an additional antiglaucomatous measure. (10 figures.)

J. Wesley McKinney.

Dashevsky, A. I. **Tonometric "expression" testing and its clinical significance in glaucoma and traumatic ocular hypotony.** Viestnik Oft., 1944, v. 23, pt. 3, p. 21.

Since 1939 the author has been using the elastotonometer (devised by him and described in the 1941 Viestnik) to secure an expression curve found useful in early diagnosis, differential diagnosis, and control of the therapy of glaucoma. The curve is the graphic record of the rate of fall of ophthalmotonus during continuous application of the elastotonometer for two minutes, noting the fall every ten seconds. It is said to help in measuring the effectiveness of filtration after operation, in deciding whether miotics alone are sufficient to control the disease, and in measuring tension in the hypotonic state. It has been noted that hypotonic eyes with good light projection show an expression curve intermediate between the normal and the glaucomatous curve. In such cases treatment with dionin, hot paraffin compresses, and subconjunctival atropine injection gave encouraging results. (Illustrated.)

M. Davidson.

Díaz Domínguez, Diego. **Causes of failure of antiglaucomatous operations.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, July-Aug., pp. 575-584.

Four principal causes of failure were noted in a series of 26 operations for acute glaucoma and 109 operations for chronic glaucoma. In the first group the cause of failure was use of iridectomy for a supposedly acute glaucoma which was in reality an acute superimposed upon a chronic glaucoma. Failure in the second group was caused by waiting too long to operate in an acute attack not relieved by medical treatment. Failure in the third group was caused by injury to the lens capsule during operation for iridectomy. This complication is avoided by using the ab-externo incision. The fourth cause of failure was malignant glaucoma in which nothing seems to be of avail. (References.) J. Wesley McKinney.

Díaz Domínguez, Diego. **The effect of internal administration of neurovegetative drugs on ocular tension in glaucoma.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 771.

The double objective of the author's investigation was on the one hand to ascertain the vegetative disturbance of the glaucoma patient, and on the other to enlarge the list of drugs in glaucoma therapy. The material consisted only of cases resistant to local action of pilocarpine. Of drugs recommended as hypotensors in glaucoma, acetylcholine and pacyl were found totally ineffective. Hypodermic use of 0.5 mg. of eserine twice daily reduced intraocular tension in some cases and was ineffective in others. Atropine internally reduced the tension in 11 out of 17 cases. in five bringing it down to normal; the effect, however, was not lasting. In one eye in which pilocarpine locally raised the tension and intensified pain, the internal administration of atropine reduced the tension and enabled the eye to tolerate the pilocarpine. Ergotamine tartrate was found effective taken internally or injected subconjunctivally, except in eyes with advanced vascular deterioration; 1 mg. three times daily was frequently effective in cases in which the rise in intraocular tension was most marked in the afternoon. A more pronounced and lasting effect was ob-

tained with ergot alkaloids, which were found effective in cases in which gynergen failed. A combination of ergotamine, atropine and luminal was tried in 21 cases; it was ineffective in nine, effective in six, and unconvincing in six. It was ineffective in advanced cases or in cases with arteriosclerotic disturbances. Good results were obtained in cases which had been operated upon without complication but with inadequate reduction in tension. A combination of ergot alkaloids with a cholin derivative was tried in 27 cases, with transitory improvement in 3, a good result in 17, and no effect in 7. This combination of drugs was effective in cases in which each drug used alone had no effect on intraocular tension. The usual dosage was 0.5 mg. of ergot and 8 mg. of pacyl three times daily. The author is convinced that this combination is more effective than any other medication used in glaucoma, and urges its use in all cases of simple primary glaucoma in which miotics do not hold the intraocular tension within normal limits. The seven cases in which the treatment was ineffective were two of absolute glaucoma, three of acute glaucoma, one of infantile glaucoma, and one of secondary iritic glaucoma.

Ray K. Daily.

Díaz Domínguez, Diego. **Ocular hypotension and primary glaucoma.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, July-Aug., pp. 566-574.

The author notes that in primary glaucoma hypotension may occur spontaneously or after instillation of pilocarpine. It has also been noted in cases of glaucoma in one eye in which the other, normal eye may respond with hypotension upon instillation of pilocarpine. Such a reaction may indicate a predisposition to glaucoma, as the tension of nonglaucomatous eye is usually not reduced by pilocarpine. The possibility of this hypotensive reaction should be kept in mind in cases of suspected glaucoma. (References.)

J. Wesley McKinney.

Krasilschikova, E. M. **Carbocholin in glaucoma.** Viestnik Oft., 1944, v. 23, pt. 6, p. 45.

This preparation (carbaminoil-cholin-chloride) used in twenty cases proved the most active of miotics. Its use makes pilocarpine more effective. When used immediately after tonometry general vagotonic effects were noted in the form of sweating, dizziness, salivation, nausea, and colic. This is attributed to sensitization by tonometry, and use of the drug is recommended not earlier than half an hour after tonometry.

M. Davidson.

Moreu, Angel. **Fundamental basis of glaucoma therapy.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 745.

The author believes that the basis of glaucoma is an endocrine organo-vegetative disturbance affecting the oculovascular circulation. The oculovascular equilibrium of the eye is maintained by coördination of the ocular sympathetic and parasympathetic regulators, which are themselves subject to the influence of the endocrine glands. For etiologic therapy it is important to determine whether it is the function of the sympathetic or of the parasympathetic that is at fault. In the former the dominating process is vascular spasm with arterial hypertension, and the rise in intraocular pressure is caused by the secondary vasodilatation which follows every adrenalinergic vasoconstriction. In irritation of the parasympathetic there is primary vaso-

dilatation, and the slightest obstruction to venous drainage may upset the intraocular balance.

Another factor of therapeutic importance is the degree of adequacy of the intraocular venous and aqueous drainage. This is ascertained by gonioscopy and a fluorescein test used in the following manner: Five c.c. of fluorescein sodium is injected intramuscularly, and the patient placed immediately at the slitlamp. He is examined every half hour for the appearance of fluorescein in and its disappearance from the aqueous. The earlier it appears in the anterior chamber, the greater the vascular permeability and the more profound the vascular changes. The more rapidly it disappears, the more adequate the intraocular aqueous drainage. The higher the tension, the greater the drainage at the iridocorneal angle, a fact proved gonioscopically by the spot of fluorescein in the angle and by the green color in Schlemm's canal. In glaucoma with low tension and good drainage fluorescein is rarely found in the angle. This test has also a prognostic value; the later the fluorescein appears, and the faster it is eliminated, the better the prognosis.

Under treatment, in addition to local, hygienic, and dietetic regime, the author lays great stress on the importance of general medication acting on the neurovegetative system. The parasympathomimetics or cholinergics act by producing a primary vasodilatation without vasomotor paralysis; experimentally their oral, subcutaneous, or venous administration had no effect on intraocular tension even if the vascular pressure fell so low that the animals died. The author condems the use of calcium in glaucoma. Cases with

obstruction to intraocular drainage, aqueous or vascular, belong to the domain of surgery.   Ray K. Daily.

Moreu, Angel. **Modern orientations in the pathogenesis and treatment of glaucoma.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, July-Aug., pp. 548-565.

The author sets forth a working hypothesis which, he states, helps to elucidate the pathogenesis of glaucoma. Upon this hypothesis a system of treatment is based. It has been noted that in the preglaucomatous state the light threshold is lowered and dark adaptation retarded. These functions are tied up with the vitamin-A content of the retina and the melanotropic hormone produced by the hypophysis, which is regulated by the optic nerve itself and the cervical sympathetic. It is supposed that a sympathicotonus invariably exists in glaucoma, and that as a consequence the vascular bed of the uvea and retina is reduced and gives origin to a vitamin-A deficit in the retina. Vasoconstriction in the hypophysis produces diminution of production of the melanotropic hormone. This explains the alterations of the light threshold and dark adaptation in preglaucoma. After a time there is a paralytic vasodilatation especially affecting the ciliary body, with edema of the ciliary body and excessive transudation of blood plasma which cannot be carried away rapidly enough by the drainage channels. At this point hypertension ensues. Basing treatment upon the above outline concept of the pathogenesis of glaucoma, the author administers continuously the sympathetic depressant, gynergen, sometimes with the parasympathetic stimulant acetylcholine. Nicotinic acid is given for its

vasodilator effect. Treatment during the stage of hypertension is not discussed. (10 graphs.)

J. Wesley McKinney.

Palomar Palomar, Alejandro. **Cyclodiathermy punctures of Vogt in the treatment of glaucoma.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, July-Aug., pp. 608-617.

Discussing the mode of action and technique of Vogt's diathermy puncture the author gives the following indications for the operation: (1) hemorrhagic glaucoma, (2) acute glaucoma after medical treatment and iridectomy have failed, (3) glaucoma secondary to iridocyclitis in which iridectomy has failed, (4) painful absolute glaucoma, (5) glaucoma in aphakia and subluxation of the lens, (6) glaucoma with adherent leucoma after failure of iridectomy, (7) glaucoma in which the anterior chamber has disappeared, (8) glaucoma with markedly constricted fields in which other antiglaucomatous operations may endanger the remaining field, (9) every case of glaucoma which other operations have not arrested the functional deterioration. (2 tables.)

J. Wesley McKinney.

Palomar Palomar, Alejandro. **Results of Vogt's cyclodiathermy in the treatment of hydrophthalmos.** Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 788.

The author reports four cases, one bilateral. In four eyes this procedure was the first operation, while in one eye it followed an unsuccessful Elliot trephining. In three eyes tension was reduced to normal and in two eyes the operation failed. The author believes that in infants this procedure reduces

intraocular tension as well as in adults. If successful the result is lasting, and the evolution of the glaucomatous process is arrested. Since most cases of infantile glaucoma are first seen in already advanced stages, when sclerectomy is dangerous, cyclodiathermy is here indicated as the first operative procedure; and in most cases it will save whatever vision is present. If there is any question as to its indication as the primary procedure, the author believes there can be no argument as to its indication in cases where sclerectomy or cyclodialysis has failed. In hydrophthalmos he considers this the operation of choice.   Ray K. Daily.

Pérez-Bufill. **Extraction of the vitreous humor in the treatment of acute glaucoma.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, July-Aug., pp. 618-620.

In a case of glaucoma following corneal ulcer and iris incarceration, and in another case of acute glaucoma, about 0.7 c.c. of vitreous was removed through a large needle. In both cases the tension was temporarily normalized. In the first case iridectomy and in the second trephining was later done with good results

J. Wesley McKinney.

Romero, Eduardo. **Hypertension of the sympathicoradial system.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 797.

In the author's conception of the pathogenesis of glaucoma, the rise in intraocular tension in simple glaucoma is attributed to a spasm of the radial fibers of the ciliary muscle, innervated by the sympathetic. The theory is that the circular and radial fibers of the ciliary body are antagonists; the cir-

cular fibers functioning in accommoda-
tion for near and the radial in accommo-
dation for distance, spasm of the radial
fibers producing a fixed spasm of ac-
commodation for distance, with a
dilated pupil! The radial fibers we are
told, are inserted into the tendinous
ring of Dollinger, which forms the
posterior wall of Schlemm's canal;
their contraction creates mechanical
obstruction to intraocular drainage and
a consequent rise in intraocular ten-
sion. The effectiveness of surgical pro-
cedures such as iridectomy and cyclo-
dialysis is attributed to destruction of
the insertion of these fibers. Cyclo-
diathermy destroys the fibers directly.
The mydriasis of glaucoma is regarded
as an expression of sympathicotony
affecting the radial ciliary and iris
fibers.   Ray K. Daily.

Rossi, Silvano, **Roentgen irradiation
of the cervical sympathetic in glau-
coma,** Arch. de la Soc. Oft. Hisp.-
Amer., 1944, v. 4, July-Aug., pp. 585-
593.

This is a preliminary report based
on the treatment of 18 cases of glau-
coma by irradiation of the superior
cervical ganglion. The results were
encouraging. In the first few hours
after irradiation there was usually a
slight mydriasis with an increase in
tension which lasted for a few hours.
This phase was followed by miosis and
lowering of tension. It is established
that the autonomic nervous system
has much to do with regulation of the
ocular capillaries, ciliary body, and
pupil, and thus the intraocular pressure.
Glaucoma is thought to be due, at least
in part, to imbalance of the autonomic
nervous system. The action of X ray
is selective, reducing the hyperfunc-
tioning elements to normal. It is
suggested that a single group of cells

may become hyperexcited, and that X
ray in suitable doses acts only on this
group of cells and not on the normal
cells. (One graph.)
                    J. Wesley McKinney.

Vishnievsky, N. A. **The diagnostic
role of elastotonometry.** Viestnik Oft.,
1944, v. 23, pt. 4, p. 15.

Elastotonometry, first proposed by
Filatov, is believed to be a valuable aid
in the diagnosis of incipient glaucoma
but cannot be depended on exclusively
for such diagnosis. Its basis is believed
to be a change in plasticity of the ocular
tissues. Experiments on rabbits, in
which the fifth or upper cervical sym-
pathetic was sectioned on one side,
showed no appreciable effect on the
curve. Nor was any effect noted on
tonograms from repetition of the same
weight or from changing the order of
procedure from high to low heights or
vice versa. Clinical application of the
method in 117 glaucoma cases, with an
incidence of hypertension in 39.8 per
cent resulted in typical elastotono-
metric curves in 76 per cent of the
cases. (Elastotonometry studies the
rate of reduction of intraocular tension
from application of increasing weights
at regular intervals over a certain
period.)   M. Davidson.

Wagner, H. Kerbacher, P., and
others. **Survey of operative results in
over two hundred cases of chronic glau-
coma treated with cyclodiathermy
puncture at the Univeristy Eye Clinic,
Zurich.** Klin. M. f. Augenh., 1941, v.
107, Nov., pp. 457-480.

Statistical compilation of the cases of
chronic glaucoma treated with Vogt's
cyclodiathermy puncture during the
years 1936 to 1941, at the University
Eye Clinic of Zurich, Switzerland,
including Vogt's private patients. Most

of the cases had been operated upon previously by various methods and many were absolutely hopeless (lack of anterior chamber, hemorrhagic glaucoma, glaucoma from venous thrombosis, persistent high tension in spite of all surgical and medicinal treatment). In one of Vogt's private cases a hypopyon keratitis occured two weeks after the operation. Otherwise not a single infection was observed. In many instances one cyclodiathermy puncture gave the desired result; in others more such operations, up to a maximum of nine, became necessary.

The following precautions are essential: perfect asepsis; strict care as to the length of the diathermy needles (not more than 0.5 mm.); keeping at least 3 mm. from limbus, to avoid lens injury and corneal lesions.

Cyclodiathermy puncture affords a patient with malignant glaucoma, uninfluenced by any other means, a fair chance not only to avoid enucleation but to preserve the function of the glaucomatous eye over a long period. The method is also suitable for painful absolute glaucoma. (2 tables.)

F. Nelson.

9

CRYSTALLINE LENS

Bischler, Vera. **Congenital total diffuse cataract.** Klin. M. f. Augenh., 1941, v. 107, Dec., pp. 571-574.

The author reports on a cataract which was presumably inherited dominantly through four generations. Only one child was examined: a parent and the grandparents were aphakic and a great-grandfather was said to have had cataract. The child in question had a diffuse opacity of practically the entire lens. Only the central pellucid interval and the very narrow band between

the capsule and the subcapsular plane of cleavage were relatively clear. This is a more severe defect of the eye than the diffuse nuclear cataract described by Vogt, in that the patients had nystagmus, amblyopia, and a barely visible disturbance of the macula (the latter seen in the mother of the patient). On the other hand no retinal detachment complicated the operation. Vogt thought that his patients were predeposed to that complication. (3 figures, references.)

F. Herbert Haessler.

Cartwright, G. E., Wintrobe, M. M., and others. **Anemia, hypoproteinemia, and cataracts in swine fed casein hydrolysate or zein. Comparison with pyridoxine-deficiency anemia.** Jour. Clin. Investigation, 1945, v. 24, May, p. 268.

Swine maintained on a synthetic diet in which protein was supplied in the form of an acid hydrolysate of casein, or by feeding zein, failed to grow and developed an anemia. Lens opacities formed in two out of three pigs maintained on acid hydrolysed casein and in two out of three animals fed zein. The cataracts involved the posterior cortex and the suture lines. It is thought that the changes are caused by tryptophane deficiency. Although faulty tryptophane metabolism occurs in pyridoxine deficiency comparison between tryptophane and pyridoxine anemia reveals marked differences. A hypothesis is offered to explain the role of tryptophane and pyridoxine in hematopoiesis. The data presented suggest that a low intake of tryptophane retards the course and diminishes the severity of the nutritional disorder due to pyridoxine deficiency in swine.

Robert N. Shaffer.

Meyer, Gerhard. **Marfan's syndrome and spontaneous dislocation of the lens.** Klin. M. f. Augenh., 1941, v. 107, Dec., pp. 580-584.

In four of five patients a spontaneous luxation of the lens into the vitreous produced a satisfactory visual acuity relatively early in life. With progressive displacement of the lens it is wise to postpone the highly dangerous extraction. The fifth case confirms this warning. The right eye became blind after operation. Dislocation of the lens into the anterior chamber is extremely rare in Marfan's syndrome. Pilocarpine is indicated in cases where this possibility suggests itself. (7 figures.)

F. Herbert Haessler.

Roetth, A. F. M. de, and Greene, P. B. **Rubella cataract.** Northwest Med., 1945, v. 44, July, p. 222.

The historical background and the syndrome of rubella cataract are discussed. These congenital cataracts are due to infection of the mother by rubella particularly in the early months of pregnancy. Frequently associated are heart lesions, mental deficiency, and microcephaly. Therapy is surgical and linear extraction is preferred to discission, because of the toughness of the capsule. Two cases are reported.

Robert N. Shaffer.

Rosen, Emanuel. **An atypical case of Marfan's syndrome.** Amer. Jour. Ophth., 1945, v. 28, Oct., pp. 1134-1138. (7 figures.)

Schönfeld, W. **Lichen disseminatus Vidal (neurodermatitis disseminata) and lenticular opacities.** Klin. M. f. Augenh., 1941, v. 107, Dec., pp. 589-597.

Fifty-two cases of Lichen disseminatus Vidal have been reported and this author adds five more. In two of his patients the associated cataract may have been a coincidental manifestation, and it is right to assume that this may also be true of some of the cases recorded in the literature. In three of his patients, however, the cataract was diagnosed by a colleague as cataracta dermatogenes. How the lesions of skin and eye are related has not been demonstrated. All of the author's patients who had cataract had also rather severe involvement of the skin, particularly on the face, and two patients had other allergic phenomena as well. The dermatologists are rather inclined to consider the skin lesion allergic in origin. It is possible that the ciliary epithelium becomes so altered that it allows anaphylactic antibodies to enter the aqueous from the blood and thus influences the metabolism of the lens. (Bibliography.)

F. Herbert Haessler.

10

RETINA AND VITREOUS

Arruga, H. **A diathermy apparatus for retinal detachment.** Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 741.

Arruga has designed a simple diathermy apparatus with an output of 60 to 120 ma., adequate for diathermy coagulation in retinal detachment. The apparatus consists of a transformer of 125-2000 volts, a tungsten spark plug, three fixed condensers, a coil, and a rheostat. The accessories comprise a pedal for foot control, a neutral pad-electrode, cords, and a handle for the active electrodes. These last are straight and curved, olive tipped for coagulation, and sharp for perforation, and are insulated with glass.

Ray K. Daily.

Bartels Martin, **Accidental injury and retinal detachment.** Klin. M. f. Augenh., 1941, v. 106, June, pp. 684-695.

We know nothing definite about the genesis of spontaneous retinal detachment. We know statistically that certain conditions favor its occurrence, and it is obvious that there must be varied opinions on the part that accidents play in its production. All we really know is that old and myopic eyes are more apt than others to have retinal detachment. It is not known whether a severe or slight or moderate myopia is most predisposed. Nor is it known whether degenerative changes associated with myopia make an eye more disposed and if so which changes, those of retina or of choroid. It is assumed that cystoid changes in the retina are particularly predisposed, but the author points out that cystoid degeneration is found also in normal eyes and even in youth. Nor is cystoid change in one particular area or stratum of the retina known to be particularly associated with retinal detachment.

To shed light on this problem Bartels selected for analysis 101 cases of his 417 in which trauma was mentioned. He concludes that after blunt injury there is almost always an interval between the trauma and development of the detachment. In cases ascribed to injury caused by heavy lifting or stooping he can see no connection but the detachment is almost always reported to have occurred immediately after the injury. This is also true of blows on the head. His conclusion from this experience is that when disturbance of vision is noted immediately after injury —aside from direct perforation or severe compression of the globe—the injury has nothing to do with the detachment.

F. Herbert Haessler.

Franceschetti, A., and Babel, J. **Hemeralopia congenita and retinitis pigmentosa in a sister and a brother.** Klin. M. f. Augenh., 1941, v. 107, Nov., pp. 506-521.

After discussion of the literature the authors report the cases of one sister with very pronounced congenital hemeralopia but without characteristic fundus changes and one brother with hemeralopia and extensive typical pigment degeneration of the retina. They conclude that from the clinical as well as the genetic standpoint congenital hemeralopia belongs to the group of retinitis pigmentosa and related retinal diseases. They propose a new classification of these ailments. (5 figures, bibliography.) F. Nelson.

Gonzales, M. B. **Intraocular tension and retinal circulation in pregnancy.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, Sept.-Oct., 802.

The conclusions from this investigation are as follows: (1) The intraocular tension falls as pregnancy advances and returns to normal one month after delivery. (2) The pressure in the central retinal artery remains unaltered in normal pregnancy and measures 50 per cent of the pressure at the forearm. (3) In toxemia of pregnancy the diastolic pressure rises 70 to 85 per cent of the tension at the forearm. This rise in diastolic retinal pressure appears before fundus changes become evident. (4) There is no relation between intraocular tension and retinal pressure. (5) During normal pregnancy the retinal vessels are tortuous and turgescent; at the onset of toxemia

they appear narrow but slightly tortuous and the fundus is ischemic. (6) Ophthalmoscopic examination enables us to make an early diagnosis of toxemia of pregnancy. For this purpose it is absolutely necessary to determine the relation between retinal and forearm diastolic blood pressures, the rise in diastolic retinal pressure being the first indication of toxemia. (Illustration.)   Ray K. Daily.

Graff, Gerd. **Periphlebitis and tuberculosis, chorioretinitis in the same eye.** Klin. M. f. Augenh., 1941, v. 107, Oct., pp. 348-354.

The coincidental appearance of tuberculous chorioretinitis and periphlebitis in the retina is not an uncommon occurrence, as the author shows by means of statistics from the Freiburg Clinic, but the opportunity to photograph the fundus of such an eye rarely presents itself. Graff contributes such a composite picture made up of seven carefully matched fundus photographs, so that a relatively large area of the fundus is presented. The frequent association of periphlebitis and other ocular diseases which are known to be tuberculous makes it seem unlikely that periphlebitis of the retina is a manifestation of endarteritis obliterans, but the author is even more convinced by the fact that he has not seen a single case of Burger's disease in any of the many patients with periphlebitis in the retina. (4 figures, references.)
                    F. Herbert Haessler.

Karbacher, Paul. **Retinal detachment and indirect trauma.** Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 240-245.

After discussing various opinions concerning recognition of indirect trauma, especially to the head, as at least an inducing factor for subsequent development of retinal detachment, the author reports briefly three cases of young (18 to 25 years) and absolutely emmetropic patients who developed retinal detachment following more or less severe head injury. (1 table.)
                    F. Nelson.

Lampert, H. **The problem of clot shrinkage and its significance in retinal detachment.** Klin. M. f. Augenh., 1941, v. 106, June, pp. 625-638.

The author reports some of his experiments with silicate gel, particularly as to variations in the coagulum with changes in hydrogen-ion concentration. Passing an electric current through a solution caused the gel to adhere to the anode and to disappear from the cathode. Extending these experiments to blood in excised veins, it was possible to recanalize a clot and thus cause it to adhere to the vessel wall, preventing embolism. The relation to retinal detachment is discussed in a short paragraph in which the author states that the vitreous can be considered as a gel. The experiments have not yet been carried out as to the vitreous but information so obtained might throw light on moot points in the problem of retinal detachment (2 tables, 5 figures, bibliography.)
                    F. Herbert Haessler.

Meyer, W. **An atypical case of retinitis punctata albescens.** Klin. M. f. Augenh., 1941, v. 107, Nov., p. 526.

A 42-year-old male, whose case had been diagnosed as one of retinitis pigmentosa when he was 17 years old, presented in the fundus a picture of rather typical retinitis punctata albescens. However, all functions were normal, including visual acuity, visual field, color perception, and dark adapta-

tion. There were no eye disturbances in the family. The condition was probably multiple drusen formation which did not impair any of the normal functions of the eye.   F. Nelson.

Polojinteva-Demina, S. P. **Vitamin-A starvation in adolescents, and effectiveness of carotene from pine needles in its treatment.** Viestnik Oft., 1944, v. 23, pt. 6, p. 38.

The examination of 136 children, one group in a school attached to a home for children and the other in a regular school, showed 9.8 percent suffering from lowered dark adaptation, and a low level of adaptation in 30.8 percent more. Those in the home fared better than the other group. Marked improvement of dark adaptation was noted in 14 out of 15 children in 5 to 14 days under use of carotene from pine needles. This improvement slowly disappeared on withdrawal of carotene. Fatigue after study periods was noted to influence adaptation. The testing was done with the Kravkov-Vishnevski apparatus, which, because of its portability and the speed with which the test can be administered, was found an excellent means of mass examination for early detection of lowered adaptation.   M. Davidson.

Rieger, Herwigh. **On the question of heredity in spontaneous idiopathic retinal detachment.** Klin. M. f. Augenh., 1941, v. 106, June, pp. 638-684.

In this 45-page lecture the author thoroughly discusses the part that heredity may play in the genesis of retinal detachment and critically evaluates the extensive literature on the subject. Vogt's views on the relationship between heredity, presenile degenerative changes, myopia, and retinal detachment are stated fully, but

the author does not believe that Vogt's position is very secure. Bartel's analysis of 500 to 600 cases of detachment suggest that familial occurrence of detachment must be quite rare. The author reports two family trees constructed from his own observations and lists about forty published by others. A report by Cibis has particular significance in that young hyperopic twins had similar detachments.

Detachment of the vitreous, however important, cannot be the only factor. It has been frequently demonstrated in eyeballs with disease of the choroid and the outer retinal strata, without any suggestion of detachment.

The author discusses the question whether one must assume the existence of a specific or nonspecific hereditary basis for idiopathic retinal detachment associated with myopia. Though nothing is proved he thinks it at least likely that a hereditary factor exists for production of the detachment that accompanies myopia. The particular manifestations which bring about hereditary detachment need probably not to be sought in the vitreous but in the retina itself. Abnormality of the glial tissue might be the basis of a progressive degenerative change in the retina comparable to abiotrophies of the central nervous system, in particular tapetoretinal degeneration. Clinically the detachment associated with myopia is characterized by almost constant presence of vitreous detachment, by a much greater incidence of retinal tear, and by much less developed histological changes in the region of the hole. The hereditary factor seems for the most part dominant but occasionally recessive. (2 figures, bibliography.)   · F. Herbert Haessler.

Rieken, H. **A method of objective**

adaptometry. Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 306-316.

The author adds to the communication given in his previous article (Amer. Jour. Ophth., 1945, v. 28, Dec., p. 1401.) and offers further critical study of the method.

Rosenblum, M. E. **Localizing diathermy coagulation.** Viestnik Oft., 1944, v. 23, pt. 4, p. 19.

While localization by means of the ophthalmoscope is quite adequate for fundus lesions, such as tears and foreign bodies, correction of ophthalmoscopic localization is often indicated, particularly when an incision has to be so made as to spare the larger retinal vessels. For this purpose a localizing diathermy coagulation with ball electrode achieves greater accuracy. It produces in the fundus a yellowish spot which serves to control the incision. It has been found useful in extraction of magnetic foreign bodies by the posterior route, in extraction of nonmagnetic foreign bodies, and in extraction of subretinal cysticercus. Ophthalmoscopy during operation is not easy, but it is facilitated by doing it as soon as possible after the beginning of the operation and by attention to the cornea to prevent its drying.

M. Davidson.

Vancea, P. **The retinal hemorrhages of the new-born.** Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 272-274. (See Section 16, Injuries.)

Vilenkina, A. J. **The eye findings in war nephritis.** Viestnik Oft., 1944, v. 23, pt. 6, p. 35.

Among 58 cases studied ten were found with transient insignificant changes, and ten others with more marked changes, consisting of peri-

papillary retinal edema and narrowing of arteries. In only one case was there a true angiospastic neuroretinopathy. The conclusions as to prognosis are that the presence of permanent retinal changes represents a primary hypertonia and poor prognosis, rather than a primary chronic nephritis.

M. Davidson.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Kenel, C. **A case of eclampsia with papilledema and retinal detachment.** Ann. d'Ocul., 1940, v. 177, no. 5, pp. 187-194.

Following lumbar puncture, severe papilledema in both eyes disappeared in several days, and in ten days both retinas were completely reattached. Two months later vision was normal in both eyes. The ocular condition was basically due to cerebral hypertension. (13 references.)   Charles A. Bahn.

12

VISUAL TRACTS AND CENTERS

García Miranda, A. **The central scotoma as an early symptom in the diagnosis of intracranial affections.** Arch. de la Soc. Oft. Hisp.-Amer., 1944, v. 4, July-Aug., pp. 465-474.

The finding of a central scotoma with or without papilledema or temporal pallor of the disc is usually indicative of an optic neuritis. Not infrequently, however, this loss of central vision is the first sign of an intracranial neoplasm which may be amenable to treatment. Further, opticochiasmatic arachnoiditis, tabes, and vascular lesions of the circle of Willis may be causative. Illustrative cases are cited. (4 figures, references.)

J. Wesley McKinney.

Giridhar, P. D. **Psychotherapy in hysterical amblyopia.** Indian Jour. Ophth., 1945, v. 6, July, pp. 32-33.

The author relates three cases of hysterical amblyopia and one of hysterical amblyopia with monocular ptosis, all treated with immediately satisfactory results by means of subconjunctival injection of 1-percent salt solution, whose application had followed assurance that "a new and special medicine" would bring back the vision immediately.   W. H. Crisp.

Kopil-Levina, E. A., and Shershevskaya, O. I. **The diagnosis and therapy of functional ocular affections in wartime.** Viestnik Oft., 1944, v. 23, pt. 5, p. 31.

Only eight cases of ocular neurosis in the material of three hospitals were noted. Interesting observations made on them were as follows. In the first place, in contrast to some statements in the literature, there was not noted any indifference of the patients to their plight or its duration, but on the contrary serious concern and an adequate psychic reaction to their functional derangement, and a sincere and exuberant joyfulness on their recovery from it. In the second place, purely functional visual field contraction is rare, and those resting on an organic basis are the majority. In the functional disturbances of central vision, there was noted as a rule an analgesia of the lids and orbit having a definite form of "spectacles" in bilateral cases and of a "monocle" in unilateral cases, that is where one eye had been enucleated. Hypnopsychotherapy not only restored vision to normal but eliminated the analgesia, without special reference to it by suggestion. Ordinary psychotherapy, without resort to hypnosis, gave no results. These cases had been considered from four to eight months as organic cases, and it is believed that an earlier diagnosis would have cured them much earlier. The difficulties in diagnosis resulted from accompanying injuries of the face with possible organic sensory disturbance. The evolution of most cases was slow, and the rapidity of onset of the functional disturbance after the trauma is not an absolutely necessary clue to diagnosis. Correct diagnosis is important in that the other neuroses such as functional deafness, are liquidated simultaneously with the ocular neurosis, and the results influence favorably recovery from simultaneous organic affections. In one case, the suggestions given during hypnosis were made through an interpreter, with equally good results. Usually two sessions of hypnotic suggestion, by a method here referred to as that of Kopil-Levina, but not further described, were sufficient to restore vision from defective light projection, in some cases to normal. In two of the eight cases, with visual-field contraction only, suggestion alone was effective. One case was diagnosed as simulation, and restoration was effected by an order to return to duty. In this case no lid analgesia was elicited, but the patient alleged inability to open his eyes for ophthalmoscopy, and the diagnosis was based on these findings.   M. Davidson.

Meyer, F. W. **Symptomatology of optico chiasmatic arachnoiditis.** Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 274-280.

Meyer describes the case of a man of 23 years who at 21 years rapidly developed a very marked dystrophic genital adipòsis, diabetes insipidus with normal blood sugar, high spinal pressure, retrobulbar neuritis with cen-

tral scotoma, and atypical Argyll-Robertson pupils (pupils not miotic). Syphilis was ruled out serologically and otherwise. (References.)

F. Nelson.

13
EYEBALL AND ORBIT

Bielikova, L. P. **The choice of material for implantation after enucleations.** Viestnik Oft., 1944, v. 23, pt. 6, p. 41.

On the basis of observation in 30 fat implantations, 11 implantations of sclera by the method of Medvedev, and 11 implantations of cadaver costal cartilage as suggested by Sverdlov, the author arrives at the conclusion that fat is the best implant. While sclera produces a good mobile stump, in some cases the postoperative edema is a disadvantage. Costal cartilage results in poor mobility of the prothesis. Only two cases of necrosis were noted in the fat implants. The presence of an inflammatory process is not considered a contraindication to use of fat.

M. Davidson.

Bursuk, G. G. **Use of gastrocnemius aponeurosis in plastic surgery of the conjunctiva.** Viestnik Oft., 1944, v. 23, pt. 4, p. 13.

In the restoration of contracted sockets, very satisfactory results are described from use of gastrocnemius aponeurosis. It is not subject to shrinking, is viable, and retains the form impressed on it. In 10 to 14 days it assumes the color of conjunctiva. The skin incision for obtaining the aponeurosis transplant has the shape of a half ellipse with convexity below and outside the crista tibiae. This incision prevents tearing out of the sutures. The aponeurosis is sutured to the un-

dermined conjunctiva. The prothesis can be put in immediately or on the following day and the sutures taken out in four or five days. Ten case histories are given, some with contracted sockets, others with complete or partial symblepharon.   M. Davidson.

Filatov, V. P. **An enucleation procedure.** Viestnik Oft., 1944, v. 23, pt. 4, p. 3.

In war surgery, where adequate and accurate anesthesia is not always possible and where enucleation is likely to be unusually painful because of the presence of orbital scars, a modification of Tillaux's procedure has been found of great advantage in dozens of cases. This method proceeds from behind forward instead of from before backward. After undermining the conjunctiva and sectioning the internal rectus, the optic nerve and ciliary nerves are cut first, and under widest possible retraction of the lids by the assistant, the globe is dislocated outward and with the aid of a sharp double hook the posterior pole is brought forward as in neurectomy. The obliques are next cut and then the remaining recti are sectioned. In cases with scars and adhesions of the globe to the inner orbital wall, Tillaux's original method of cutting the external rectus and dislocating the globe inward may be substituted.

M. Davidson.

Jaensch, P. A. **Posterior orbital cephalocele.** Klin. M. f. Augenh., 1941, v. 107, Dec., pp. 561-571.

In the large subject of brain herniation only two manifestations interest the oculist, namely anterior (naso-orbital) and posterior (spheno-orbital) orbital cephalocele. The latter is rare

and the author therefore records two case histories. Diagnosis depends on the observation of pulsation of the eyeball without bruit and an exophthalmos with displacement of the eye down which is easily reduced by pressure and is followed after a time by transient enophthalmos. A roentgenogram is of great value. Only 24 cases have been recorded thus far. Mortality is high. Most of the patients are young, symptoms develop very gradually, and the average duration is 14 years. The first of the author's patients is remarkable in that the disease started in early childhood after injury and now at the age of 79 years the patient still enjoys a good reputation as an active and capable business man and hunter. The other patient, a 32-year-old woman, also presented the typical clinical picture. In her roentgenogram the absence of bone is so great that it is probable the right orbit is separated from the interior of the skull only by a membrane. On stero-plates one has the impression of looking through the skull. In both patients the roentgenogram suggests bone destruction by a malignant neoplasm, but there is no known growth that continues to exist for 30 or even 79 years. (5 figures, bibliography.)   F. Herbert Haessler.

Johnson, L. V. **A simple rubber form for the reconstruction of a contracted socket.** Amer. Jour. Ophth., 1945, v. 28, Nov., p. 1260.

Kozmin, V. I. **Electrocoagulation of of the conjunctival socket in plastic operations.** Viestnik Oft., 1944, v. 23, pt. 4, p. 40.

Free transplants have not provided the author with permanent results in dealing with contracted sockets. The best results have been from the use of scrotum, which is thin and elastic. Superior results have been achieved by electrodiathermy coagulation. It has the advantage of economy of palpebral tissue, rapidity of scar formation, and minimal shrinking. The conjunctiva is deeply undermined both anteriorly and posteriorly, the underlying scars thoroughly burned out, and the conjunctiva replaced (sometimes sutured). The prothesis is immediately put in and is kept for 7 to 10 days. The result is a deep and permanent fornix holding the prothesis well.

M. Davidson.

Senna, Sertorio. **A rare and grave complication of enucleation.** Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 814.

Senna reports two cases of severe hemorrhage, one six days after the enucleation, and the second immediately after section of the optic nerve. Each was controlled by a deep purse-string catgut suture which compressed the deep orbital tissues, including the optic nerve.   Ray K. Daily.

Sudakievich, D. I. **The first experience with use of plastic material for orbital prothetization.** Viestnik Oft., 1944, v. 23, pt. 6, p. 43.

The use of plastic material was begun in March, 1943. The addition of pigment—the most useful ones being pink and yellow—results in a prothesis equal in semitransparency and delicacy of color to that of glycerine-gelatin. The prothesis is attached to a spectacle frame. Because of complicating bone injuries in these cases, close cooperation between the surgeon and the prothetist is required in achieving good results. In some cases a rubber prothesis serves best.   M. Davidson.

14

EYELIDS AND LACRIMAL APPARATUS

Awerbach, M. I. **Some remarks anent Strakov's article on dacryocystitis in peace and war.** Viestnik Oft., 1944, v. 23, pt. 5, p. 9.

As partly responsible for the thesis of Ivanova referred to in Strakov's article (see below), the author points out that, in spite of apparent contra-indications on theoretical grounds, successful rhinostomies have been performed. He suggests that the suturing is not so important as the size of the osseous window achieved, and that many operators use sutures sparingly. The author believes that he who knows how to do a dacryocystorhinostomy is capable of doing an extirpation, should the occasion present itself, but that he who has only learned to do an extirpation is handicapped in doing the other without special training.

M. Davidson.

Brown, J., and Cannon, B. **Full-thickness skin grafts from the neck for function and color in eyelid and face repairs.** Annals of surg., 1945, v. 121, May, p. 639.

Full-thickness grafts from the neck and clavicular region have been found to give superior results in the repair of facial defects. Two main advantages are improved function and color. The color is nearly always close to that of the normal face. Good function is due to thickness and softness and possibly also the character of the skin which naturally overlies a platysmal muscle. Main areas for use are on the lids, in the canthal regions, about the ala, over the nose, and about the eyes and the angles of the mouth. The authors present diagrams and pictures, and discuss procedures involving skin grafts in facial repair.

Theodore M. Shapira.

Davids, Hermann. **Contribution concerning treatment of dacryocystitis phlegmonosa.** Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 238-240.

Treatment is, if possible, conservative. If repeated cautious massage and poulticing fail to produce pus either upward or downward the lower canaliculus is probed, but the probe is only introduced into the sac, not into the lacrimonasal duct. While the probe is being slowly withdrawn, the author again attempts to evacuate pus by gentle massage. If that attempt is unsuccessful he tries to aspirate pus through a blunted irrigation needle. This is usually easy to do. Pus is to be expressed first every two hours, later four to five times daily, then three times daily. Apparently this routine by no means makes later operation on the tear sac unnecessary.

F. Nelson.

Hughes, W. L. **Reconstruction of the lids.** Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1203-1211. (9 figures, references.)

Nizetic, Zdravko. **Tarsal extroversion in trachomatous entropion.** Ann. d'Ocul., 1940, v. 177, no. 6, pp. 211-217. (See Amer. Jour. Ophth., 1941, v. 24, p. 837.)

Saurez Villafrance, M. R. **New contributions to palpebral surgery.** Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 816.

The distinctive features of the author's technique are: (1) Preoperative preparation of the forearm from which the grafts are cut; the arm is dressed

with an antiseptic dressing for four days preceding the operation. (2) Forceps which the author devised for holding the graft; they are similar to hemostats except that they end in sharp cross-action prongs; the one-pronged model is used for small grafts, while the two- and three-pronged instruments hold larger grafts. The claim made for them is that they minimize the trauma to which the grafts are subjected in holding, and thus reduce the danger of necrosis. (3) For cicatricial ectropion of the lower lid the author uses Elschnig's free transplants. (4) For restoration of the lower lid and conjunctival sac he resorts to a combination of a deep free graft, a superficial sliding graft, and the lower third of the tarsus of the upper lid. (5) Repair of traumatic coloboma of the lids is done with the sliding flaps of Celsus and Knapp and excision of Burrow's triangles, supplemented by a third fatty-cutaneous flap from the cheek. (Illustrations.)   Ray K. Daily.

Soria. **Twenty years of dacryocystorhinostomy.** Arch. de la Soc. Hisp.-Amer., 1944, v. 4, Sept.-Oct., p. 807.

Soria reviews briefly the evolution of his technique since he began the Toti operation twenty years ago. Anesthesia is achieved through the three subcutaneous injections described by Chevrièr and Cantonnet for extirpation of the lacrimal sac supplemented by topical intranasal cocainization of the operative field. The osseous orbitonasal perforation does not exceed 9 mm. in diameter, and is placed as low as possible to avoid making the lower portion of the sac a reservoir for secretion. The bone is carefully perforated with an electric trephine, supplemented by the use of a chisel if

necessary to avoid injuring the nasal mucous membrane. The posterior lip of the incised lacrimal sac is sutured to the incised nasal mucosa; the anterior lip of the sac is sutured to the periosteum at the bony opening into the nose. Suture of the skin and a compressive bandage complete the procedure. To facilitate trephining and avoid friction between trephine and bone, the writer devised a trephine tip with sawlike teeth which are inclined alternately slightly in and out. The periosteal elevator is a reduced model of the large elevators used in general surgery. A protector longer and wider than those commonly in use guards the lacrimal sac from injury during the trephining. Stress is laid on the importance of postoperative irrigation of the new drainage channel; this is begun as soon as the cutaneous sutures are removed. The irrigation cleanses the deep wound of secretions, washing them into the nose; it also stimulates epithelization of the denuded areas, and prevents development of granulomata, which might cause a poor surgical result. (Illustration.)
       Ray K. Daily.

Spaeth, E. B. **Acquired blepharoptosis.** Amer. Jour. Ophth., 1945, v. 28, Oct., pp. 1073-1087. (1 table, 49 figures, references.)

Strakov, V. P. **Dacryocystitis in peace and war.** Viestnik Oft., 1944, v. 23, pt. 5, p. 4.

The author reviews the progress in treatment of dacryocystitis from the time, fifty years ago, when the most conspicuous group of patients in the Moscow Eye Clinic were those with lacrimal sounds in their tear passages and dark bands of argyrosis on their

faces, from the silver-nitrate irrigations to which they had been subjected down to the dacryocystorhinostomies of our days. The author believes that many cases of epiphora can be handled conservatively, and he is against the advocacy by some authorities, particularly Ivanova, of abandoning extirpation entirely in favor of dacryocystorhinostomy. The latter he believes contraindicated (1) when the canaliculi are impermeable or nonfunctioning, since their role in tear conduction is paramount; (2) when there is likely to be difficulty in suturing the sac to the nasal mucosa, because of atrophy or fragility of the sac wall or hydrops of the sac with diverticuli; (3) in the presence of parasinusitis, especially ethmoiditis; (4) in tuberculosis of the sac or acute dacryocystitis; and (5) in the aged and feeble. Prevention of epiphora from war injuries is important, and careful suturing of canaliculus injuries is the chief means of achieving it. In 1942 and 1943, in one evacuation hospital there were performed 101 dacryocystitis operations—70 percent dacryocystorhinostomies and 30 percent extirpations. In the 12 traumatic cases extirpation and rhinostomy were equally represented. Because of scar tissue and bony deformations in these cases canaliculorhinostomies had to be performed. In the absence of studies of end results of rhinostomy in the U.S.S.R. the author believes that the young ophthalmologist should be trained in sac extirpation and that a well-done extirpation is better than a poorly done dacryocystorhinostomy. M. Davidson.

15
TUMORS

Goodsitt, Edward. **Metastatic carcinoma to the choroid arising from the** lip. Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1256-1259. (5 figures, references.)

Kreibig, Wilhelm. **The clinical diagnosis of angioma of the choroid.** Klin. M. f. Augenh., 1941, v. 107, Dec., pp. 597-621. (9 illustrations, including 1 color plate, references.)

Of the fifty choroidal angiomas which have been reported since 1885 all but 15 were discovered in histologic studies of blind eyes. Of the 15 eyes which had been studied ophthalmoscopically the majority were enucleated with a clinical diagnosis of sarcoma.

The diagnostic characteristics must be evaluated with caution since most of the manifestations could also occur with sarcoma. Sooner or later an angiomatous eye leads to blindness and must be removed for painful glaucoma, hence enucleation is indicated when in doubt because the alternative diagnosis is sarcoma. The most helpful manifestation is extensive angioma of the skin of the face surrounding the eye. The color is also suggestive. It is described as pale yellowish-red with striking bluish and greenish reflexes from the steeper edges of the protruding mass. The tumor itself is always much more extensive than the protruding mass. Slight or absent pigmentation on its surface suggests angioma. An irregular knobbed surface suggests angioma. Juxtapapillary site not involving the disc also speaks for angioma. Macular degeneration with areas of cicatricial membrane is not uncommon, and occurrence during youth is suggestive.

The reported cases may be naturally divided into two classes: (1) those that are associated with facial angioma, that have had amblyopia since childhood, and that are certainly congeni-

tal; (2) those that have evidence of having had perfect vision, that have no facial hemangioma, and in which the manifestations of tumor arise later in life. The author reports in great detail clinical and histologic studies of three cases.   F. Herbert Haessler.

Velhagen, K. **Diagnostic puncture when suspecting choroidal sarcoma.** Klin. M. f. Augenh., 1941, v. 107, Oct., pp. 354-361.

Velhagen describes his findings in three cases of choroidal sarcoma where diagnostic puncture was permissible and indicated. The procedure is not without danger, because any trauma to an eye afflicted with a malignant growth increases the danger of immediate metastasis although puncture is perhaps not so dangerous as is generally believed. The procedure is particularly valuable when vitreous hemorrhage obscures the view or when a large retinal detachment accompanies a small sarcoma. As one of the author's cases shows, a retinal tear may occur even in detachment caused by choroidal sarcoma. In the first enucleation for sarcoma which he saw as Axenfeld's assistant, the condition turned out to be a simple serous detachment. If diagnostic puncture is to be done, it is important to strive to obtain a specimen of subretinal fluid with as small an admixture of blood as possible. Three examinations should be made: (1) of smears from the material obtained by centrifuging the specimen of subretinal fluid; (2) a paraffin section of the same; (3) the melanin reaction described by Cibis.

Microscopic study of the preparations referred to in (2) reveals blood corpuscles, fibrin networks, and large irregular cells, occasionally with pig-ment and large irregular nuclei. These cells are not round or spindle-shaped as one expects from histologic preparations of the tumor. They occur singly and in clumps of various sizes. It is important to draw diagnostic conclusions only from a study of clumps of cells. The single cells may not be reliably distinguished from ciliary-body epithelium or large histocytes such as are also seen in serous detachment.

For the Cibis melanin reaction one places a drop of subretinal fluid on a piece of filter paper which has been saturated with ferric chloride. When the reaction is positive for melanin the area becomes brown and remains so. The albumin of the exudate coagulates and the brown spot becomes sharply defined. In a negative reaction the area on which the fluid was dropped becomes paler.

Two pairs of illustrations show the appearance of cells from the subretinal fluid as compared with a histologic section of tumor from the same eye. (4 illustrations, references.)

F. Herbert Haessler.

16

INJURIES

Baltin, M. M. **Treatment of facial burns with Bucky's border rays.** Viestnik Oft., 1944, v. 23, pt. 6, p. 27.

In second-degree burns, involving lids, the use of bucky rays has proved most effective in the prevention of scar formation due to secondary infection of vesicles. The rays are analgesic, and promote rapid epithelization and drying up of secretion. Any scabs, or caking of streptocide powder, prevent penetration of the rays. Hence the method is not effective in third-degree burns.   M. Davidson.

Baltin, M. M. **The extraction of intraocular foreign bodies.** Viestnik Oft., 1944, v. 23, pt. 5, p. 20.

Difficulty in extracting with the magnet is no proof of nonmagnetic nature, as is often hastily assumed. Greater accuracy in X-ray localization is being achieved by the Comberg-Baltin procedure. Making the scleral opening as close as possible to the foreign body is perhaps more important than prophylactic electrocoagulation. Other points are discussed.
M. Davidson.

Bartels, Martin. **Accidental injury and retinal detachment.** Klin. M. f. Augenh., 1941, v. 106, June, pp. 684-695. (See Section 10, Retina and vitreous).

Brodsky, B. S. **New permanent hand magnet in the light of present-day magnet-operation methods.** Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1245-1251. (2 figures, references.)

Brodsky, B. S. **Scleral opening in the extraction of magnetic foreign bodies.** Viestnik Oft., 1944, v. 23, pt. 4, p. 38.

Sectioning the sclera with a knife, whether meridionally or tangentially, has disadvantages. The foreign body may catch in the lips of the incision, and the incision has often to be enlarged to permit extraction. The author has made use of the Filatov-Martzinkovsky trephine of 1.5 to 2 mm. diameter (with either a sealed partition or a movable piston inside of it) to remove a scleral disc which is sometimes left on a hinge. The choroid and retina are not opened by incision, but are perforated by the foreign body in its exit. The disc is replaced and only conjunctiva is sutured over it. In only two cases was it necessary to incise the choroid, and in only one case was introduction of the magnet tip into the vitreous necessary.   M. Davidson.

Friedman, S. J. **The prophylaxis, diagnosis, and treatment of sympathetic ophthalmia in the light of further observations.** Viestnik Oft., 1944, v. 23, pt. 5, p. 37. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Friemann, Werner. **Prognosis of simultaneous eye and brain injuries.** Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 265-271.

Friemann reports the case of a railroad worker who suffered a perforating injury of the right eyeball and orbit. A splinter, probably a piece of iron, had entered the brain and could be localized in the right temporal lobe (X ray). The vision of the injured eye was lost at once, and the eye was eviscerated because of danger of sympathetic ophthalmia. In contrast to many other observations which lead to the assumption that the prognosis of such combined injuries is usually very doubtful or hopeless, this patient did not show any neurologic or psychiatric symptoms during an observation period of $3\frac{1}{2}$ years, with the exception of a moderate forgetfulness and occasional conditions which might be construed as epileptiform mental absences. (References.)   F. Nelson.

Goldfeder, A. E. **Plastic operations to repair the wider palpebrofacial defects from gunshot injuries.** Viestnik Oft., 1944, v. 23, pt. 5, p. 27.

All defects may be classified into two major groups, of which there are several subdivisions. One group has essentially a triangular form, with apex on cheek and base corresponding

to palpebral fissure, and is the most common, 13 such cases being here mentioned. The less common group is more or less quadrangular, with a side instead of an apex on the cheek. Three such cases are cited. The principle followed was to utilize the mucosal floor of the defect to reconstruct scar tissue of the border of the defect for formation of the lower fornix, inner layer, and lid border; and a skin-cartilage flap from the ear for the outer layer. Sutures are used only when the transplant shows a tendency to shift its position with eye or jaw movements. The first group is repaired in one stage, the second in two stages, with two to three weeks interval. The first stage diminishes the area of the defect, while the second stage reconstructs the lower lid and border, out of the transplanted flap alone or in combination with mucosa. This operation is best done 4 to 5 months after injury. The contraindications are: osteomyelitic processes, dacryocystitis, excessive hyperemia of the defect, and friability of its floor. The same method has been applied to rebuilding the upper lid. The results have been highly satisfactory from the cosmetic as well as the functional viewpoint. (Illustrated.) M. Davidson.

Hofe, K. vom. **Clinical contribution to the understanding of keratitis neuroparalytica.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 154-159. (See Section 6, Cornea and sclera.)

Ivanova, N. K. **Magnet extraction of foreign bodies from the ciliary body.** Viestnik Oft., 1944, v. 23, pt. 6, p. 9.

In the special hospital for magnet extraction, 347 foreign bodies were extracted from eyes, and 67 attempts were unsuccessful. Extraction was di-

ascleral in 89 percent of the cases, including 8 percent from the ciliary body. Attempts in two cases to extract the foreign body from the ciliary body via the anterior route, while removing the cataractous lens were unsuccessful, but the aim was accomplished satisfactorily by the posterior route. The 30 foreign bodies in the ciliary body had entered via the cornea in 6, via the limbus in 7, and via the sclera in 17 cases. Four of them were in the opposite part of the ciliary body, and almost all in the lower part of it. The fragments varied in size from 1 by 1 mm. to 5 by 2.5 mm., the majority being less than 3 mm. Hemophthalmos was present in more than one half of the cases. Because of delays in intermediate stations, the extractions were done in one half of the cases between eight and thirty days, in the other half up to six months after injury. In a few cases the ciliary body had to be incised for removal. Magnet testing was found a sound procedure, since extraction was unsuccessful in the only two cases where the test was not positive. The eye had to be enucleated in only two cases. There were no complications otherwise. The end results however are not available, because of early transfer of the patients to rear hospitals. The author regards removal of foreign bodies from the ciliary body as no more dangerous than from other parts of the eye. M. Davidson.

Kaminskaya, Z. A. **The surgical treatment of hemophthalmos.** Viestnik Oft., 1944, v. 23, pt. 6, p. 3.

While hemophthalmos is one of the most frequent complications of contusions and perforating injuries, neither the source of the hemorrhage nor the process of its absorption are yet quite clear, particularly with reference

to retrolental hemorrhages. According to Fuchs, hemolysis and absorption begin in three or four days, take six to eight weeks, and are accomplished by the nonpigmented cells of the ciliary epithelium. The coagula formed in the neighborhood of the source of the hemorrhage requires a longer period for disintegration and absorption. The metabolism of the vitreous is thereby accelerated, and it liquifies and becomes impregnated with fine pigment dust (visible with the slitlamp. and at times with the formation of synchosis scintillans particles. Absorption is retarded by proximity to the globe wall and lens, and by inflammatory reaction while blood from the central part of the vitreous is more readily absorbed. The main purpose of treatment is to prevent formation of connective-tissue bands from glial proliferation, and their contraction incident to the presence of unabsorbed blood. The most effective method for stimulating absorption has been found to be Zur Nedden's aspiration of vitreous, and excellent results were achieved in 19 out of 25 cases in which this was applied. In some cases a preliminary scleral incision with a knife was used before introducing the needle. In these cases it was noted that the blood accumulation was not only in the vitreous but in the perichoroidal space, from which, before puncturing the choroid, large quantities of hemolysed blood would pour out. Aspiration was performed every six weeks, beginning with three drops and increasing to six drops. The visibility of the fundus and the visual acuity were noted to increase after the first aspiration.   M. Davidson.

Kaplan. J. **Xanthopsia from chronic acriquine poisoning.** Ann. d'Ocul.,

1940, v. 177, no. 5, pp. 194-205. (See Amer. Jour Ophth., 1939, v. 22, July, p. 820.)

Katznelson, A. B. **Orbit and sinus injuries with foreign bodies in the sinuses.** Viestnik Oft., 1944, v. 23, pt. 5, p. 14.

Thirty-six cases of foreign bodies in the sinuses and outside of them are reviewed from clinical and localization aspects. Of the nine sphenoidal cases two presented the "traumatic superior orbital fissure syndrome" with exophthalmos, ptosis, ophthalmoplegia, and neuroparalytic keratitis. In the nontraumatic syndrome only corneal anesthesia results, from involvement of the trigeminal nerve. Two cases of optic atrophy were included. The fundus lesions were usually double: one at the point of contact and the other one at the posterior pole. Recurrent intraocular hemorrhage was observed in some and was attributed to injuries to the venae vorticosae. The rhinologic symptoms were not marked. The 11 ethmoidal cases showed the most inflammatory reaction. There were five frontal-sinus cases. Among the 11 antrum cases five foreign bodies were found in the contralateral antrum. The antrum cases were characterized by neuralgia of the infraorbital nerve, and by more serious globe injuries, eight of the 11 requiring enucleation. The cerebral-contusion symptoms in all of them were rather mild.

M. Davidson.

Klien, B. A. **Chronic posttraumatic syndromes leading to enucleation.** Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1193-1203. (3 tables, 8 figures, references.)

Kopp, I. F. **The surgical problem in perforating injuries of the ciliary-body**

region. Viestnik Oft., 1944, v. 23, pt. 6, p. 18.

The pessimism of the past in regard to ciliary-body injuries is not valid today. It should be borne in mind that it is not the injury to the ciliary body itself but the method of handling it and its role in the supervening iridocyclitis which are important. Many apparently hopeless cases may be salvaged by proper handling of the wound. This requires careful inspection, complete analgesia, and adequate akinesia. Prolapsed vitreous should be ablated, and prolapsed ciliary body replaced if recent and excised if exposed for longer than 48 hours. A gaping scleral wound is sutured. The results of proper handlings have been as follows: Only one eye out of 11 was lost in industrial-injury cases with retained foreign bodies; while those saved were 7 cases out of 19 nonindustrial injuries without foreign bodies, late in securing treatment, and 10 already showing panophthalmitis; 22 out of 30 war injuries seen late (5 days or longer after injury); and 14 out of 18 cases seen early.

M. Davidson.

Kovalevsky, P. S. **Results of secondary hermetic closure of granulating wounds of the lids and adjacent areas.** Viestnik Oft., 1944, v. 23, pt. 5, p. 45.

Primary suture of wounds of the lids and adjacent areas is effective only within six hours after injury. Even then, under war conditions, resulting infection undoes the work. The result is an ugly large granulating surface, which if neglected is difficult to handle afterward. Secondary suturing is however feasible within six days, or, in case of infection, within 12 days after injury. The results are smoother scars with less tendency to adhesions. At times it is impossible to close the whole open wound, but much is accomplished by partial closure. It is helpful sometimes to freshen the borders of the defect before suturing. Granulating surfaces should be closely approximated, pockets avoided, and when it is impossible to avoid these drainage is provided for by tampon. In 187 cases this has not resulted in a febrile reaction, and the convalescence period has been hastened. M. Davidson.

Krasnov, M. L. **An unusual foreign body in the orbit.** Viestnik Oft., 1944, v. 23, pt. 4, p. 10.

This unusual case is reported to illustrate the fallibility of X ray and anamnesis. A young soldier was injured while wrestling, in the course of which he struck his right eye and the root of his nose. The left eye became blind. The X ray was negative. Neurologic examination was negative except for ophthalmoplegia and amaurosis. The diagnosis was cerebral concussion with orbital hemorrhage. While in the hospital for observation, two weeks later, the patient developed an abscess above the inner canthus of the right eye. Incision and exploration revealed a 2½-inch piece of lead pencil which had penetrated the right orbit, passed through the ethmoids and injured the left optic nerve, with permanent optic atrophy resulting. A reexamination of several X rays previously reported as negative showed faintly the outline of the pencil with the lead traceable through it. After operation the ophthalmoplegia disappeared. M. Davidson.

Krückels, H. **Burns of the eye with brilliant green.** Klin. M. f. Augenh., 1941, v. 106, May, p. 571.

Brilliant green is an aniline dye used

in treatment of various skin diseases, especially chronic eczema, fungus diseases, and parasitic skin lesions. Already in 1912 Römer's, Gebb's and Löhlein's experiments proved that application of a 1-percent watery solution caused chemosis in rabbits' eyes. A case is reported. The patient had been treated by an oculist for simple conjunctivitis for a considerable time. Eventually the doctor prescribed a 1-percent brilliant-green solution. There resulted severe destructive hypopyon keratitis with necrosis of the conjunctiva, terminating in bilateral blindness with good light projection.

                              F. Nelson.

McCulloch, Clement. **Changes at the macula due to solar radiation.** Amer. Jour. Ophth., 1945, v. 28, Oct., pp. 1115-1122. (2 diagrams, references.)

Mielke, Sophus. **Rusting of intralenticular iron splinters.** Klin. M. f. Augenh., 1941, v. 107, Oct., pp. 422-425.

Mielke describes an eye with an intralenticular ferruginous foreign body in which the significant observation was rusting of only the anterior tip of the splinter while siderosis spots were already present under the anterior capsule. It is probable that the distribution of metallic ions in the ocular tissues depends upon the action of a current and that accumulations take place behind relatively impenetrable membranes (lens capsule and Descemet's membrane in chalcosis). When an electrolyte lies in the path of an electric current it becomes a secondary conductor, that it, its end which is directly toward the anode becomes a cathode and the other end an anode. Observation of this case of intralenticular foreign body suggests that the current flows toward the anterior part of the eye. Particles will be carried only from the anode (that is the anterior end) into the tissues, to be deposited behind the first effective barrier, the lens capsule, which is the characteristic site of siderosis spots. The author has done experimental work to elucidate these facts, but this is the first clinical observation that confirms his experiments. (1 figure, references.)   F. Herbert Haessler.

Moncreiff, W. F., and Scheribel, K. J. **Penetrating injuries of the eye.** Amer. Jour. Ophth., 1945, v. 28, Nov., pp. 1212-1220. (11 tables.)

Paez Allende, Francisco. **Foreign bodies on the cornea.** La Semana Med., 1945, v. 52, Sept. 6, p. 371.

The author insists on the importance of using thorough preliminary lavage (after complete anesthetization) before employing a foreing-body needle, especially when the foreign body is in the pupillary area.   W. H. Crisp.

Peter, A. L., and Rosen, E. **The importance of injecting air into Tenon's capsule even in cases of foreign bodies within the eyeball.** Amer. Jour. Ophth., 1945, v. 28, Oct., pp. 1140-1144. (4 figures, references.)

Plitas, P. S. **The extraction of non-magnetic intraocular foreign bodies.** Viestnik Oft., 1944, v. 23, pt. 4, p. 4.

The author gives a detailed statement of his own technique.

Proptopopov, B. V. **Matched blood and plasma transfusion in iridocyclitis.** Viestnik Oft., 1944, v. 23, pt. 6, p. 12.

The author has used blood transfusion in traumatic iridocyclitis in 120 cases. Matched blood was used in one

hundred cases, after plasma use in twenty cases was found ineffective. In the cases with foreign-body retention, transfusion was used both before and after extraction. Local therapy when indicated was not neglected. The results in 35 cases were notably good, with relief of pain and tenderness, lessening of ciliary injection, photophobia and lacrimation, rapid absorption of exudates and hemorrhages, normalization of intraocular pressure, greater effectiveness of mydriatics, and better wound healing. Less significant improvement was shown in 44 cases. In 19 cases no improvement was noted, and two cases were worse after use. The author therefore considers transfusion useful and from experimental work on rabbits he concludes that the measure acts as desensitizer of the eye.

M. Davidson.

Radzikhovsky, B. L. **Sequestrotomy in gunshot orbital injuries.** Viestnik Oft., 1944, v. 23, pt. 4, p. 34.

In one base hospital 20 percent of all gunshot orbital injuries were complicated by osteomyelitis, and 31 cases were operated upon. The best time to operate has been found to be 1½ months after injury, when all inflammatory reactions have subsided and only a fistula remains. The help of the rhinologist is invoked when the sinuses are involved, and that of the neurosurgeon when intracranial extension is suspected. M. Davidson.

Ratinova, K. A. **Some therapeutic procedures in traumatic iridocyclitis.** Viestnik Oft., 1944, v. 23, pt. 6, p. 14.

When other methods fail, two procedures have proved of benefit. (1) Decompressive scleral trephining: Based on observation of beneficial effect of attempts at removal of foreign bodies in the presence of an inflammatory reaction, even when the attempt was unsuccessful, the author has used it in 16 apparently hopeless cases, 13 of them with nonmagnetic foreign bodies retained. A scleral flap instead of a linear incision is used. Only in four was the choroid opened. In some cases the procedure acts as would an antiglaucomatous operation although its effect is attributed to reduction of inflammatory uveal tension. Hemophthalmos was present in three cases. Three eyes had to be enucleated. Of the rest, in two improvement ranged from light perception to hand movements. (2) Retrobulbar injection of 40 percent alcohol with 1 percent novocaine. This was used in 45 cases. It is a most potent analgesic, when for psychologic reasons enucleation is not feasible, as is the case in the young one-eyed person. M. Davidson.

Rones, B., and Wilder, H. C. **Traumatic ocular injuries in soldiers.** Amer. Jour. Ophth., 1945, v. 28, Oct., pp. 112-114. (7 tables.)

Rosenblum, M. E. **Localizing diathermy coagulation.** Viestnik Oft., 1944, v. 23, pt. 4, p. 19. (See Section 10, Retina and vitreous.)

Satz, L. B. **A case of fatal purulent meningitis following an eye injury.** Viestnik Oft., 1944, v. 23, pt. 6, p. 47.

In the case described an injury apparently limited to the eye, and resulting in its enucleation, led to meningitis because of an overlooked intracranial foreign body. M. Davidson.

Scharf, Josef. **Demonstration of an intraocular foreign body by means of gonioscopy.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 193-196.

A patient suffered a penetrating injury of the globe while cracking coal. It was impossible to demonstrate the presence of a foreign body with the help of the ophthalmoscope, slitlamp, or roentgen ray. The eye healed and became relatively quiet, but in four years severe inflammation reappeared. By this time gonioscopy had become available and a foreign body which had characteristics suggesting wood was seen. A piece of wood was indeed removed from the eye surgically, and, on questioning, the patient admitted that instead of striking only the lumps of coal he might have struck the wooden box in which they were stored. (2 figures.)   F. Herbert Haessler.

Schmidt, Martin. **The operative treatment of corneal wounds.** Klin. M. f. Augenh., 1941, v. 107, Oct., pp. 410-421.

The usual treatment of corneal laceration or perforation is to cover with a conjunctival flap. Direct suture is more difficult and takes longer to heal, but it is worthy of more extensive application to those wounds which are irregular and extensive. Suturing makes exact coaptation of the wound edges possible, and in cases where the iris is intact it makes healing possible without anterior synechia and with preservation of a normally functioning pupil. In a series of 32 cases only two eyes were enucleated and in many useful vision was retained. (1 table, 10 figures, references.)
F. Herbert Haessler.

Shershevskaya, O. I. **Ocular-fundus lesions in war injuries.** Viestnik Oft., 1944, v. 23, pt. 4, p. 31.

The most common choroidal ruptures are polygonal. Holelike ruptures are seen mainly in the macula. In dimensions they vary from punctate ruptures to those involving one half of the fundus. Hemorrhages may accompany them: these are very slowly absorbed and can be seen months afterward. When the rupture spares the outer layers of the choroid its color is yellowish it is relatively small, slitlike, or sickle-shaped, with indistinct margins and usually nonpigmented. The complete ruptures, in addition to the white color of the visible sclera, show more intensive pigmentation. Ruptures close to the optic nerve may simulate myopic changes. When in the periphery the chorioretinitic changes may simulate nontraumatic lesions. Among secondary changes may be observed an ascending atrophy of the optic nerve and a degenerative maculitis. One extremely rare case presented detachment of the pigment epithelium, in the form of a markedly depigmented disc surrounded by a dark brown ring the inner border of which was serrated and obviously elevated, while the outer border of the ring was on a level with the rest of the fundus. Retinal ruptures are considerably rarer, and are mostly in the macula, but occasionally peripheral. In the macula they sometimes simulate Kuhnt-Junius macular degeneration. They very rarely result in detachment, and heal readily with scar formation even when large. There is also marked polymorphism of macular lesions, which vary from disappearance of the physiologic foveal reflex, and macular discoloration, to large macular holes. In addition to occasional optic-nerve atrophies, three avulsions of the optic nerves were observed. All three cases were accompanied by enophthalmos and disturbed motility of the globe. The same polymorphism noted before was observed in connection with fixed and floating vitreous opaci-

ties. Occasionally an opacity would be so brightly colored as to suggest a foreign body.　　　　M. Davidson.

Shershevskaya, O. I. **Physiotherapy in war injuries of the eyes.** Viestnik Oft., 1944, v. 23, pt. 4, p. 27.

The conditions most responsive to physiotherapy have been hemophthalmos, traumatic iritis and iridocyclitis, and injuries of the lids and neighboring parts. Hemophthalmos was favorably influenced by diathermy with subsequent iodine iontophoresis, or by galvanic ion-diathermy with iodine. Diathermy treatments of two courses of two weeks each, with an interval of two weeks between, usually seemed to help in clearing up the vitreous. Iritis and iridocyclitis have benefited considerably from galvanic ion-therapy with adrenalin or atropine (depending on indications) combined with erythema doses of ultraviolet or ultrashort-wave therapy. Suppurative wounds and hypertrophic scars of lids and adjacent parts were benefited remarkably from paraffin therapy. Paraffin can be raised to a temperature of 70 to 75 degrees C. Because it retains heat and gives it up slowly and uniformly it does not harm tissues, and its heat penetrates deeply without dilating the surface vessels. A protective plate is placed under the lids to prevent injury to the globe, and care is taken that no water drops are mixed with the molten paraffin as otherwise a burn will result. The paraffin is applied for one hour 20 to 30 times.
　　　　　　　　M. Davidson.

Tikhomirov, P. E. **Salvaging the war blind.** Viestnik Oft., 1944, v. 23, pt. 5, p. 10.

Perforating eye injuries are the most common of all injuries in war time and are more serious than those of peace time. They account for most of the war-blinded. Blindness resulting from eye contusions is much less frequent. In the statistics of some hospitals bilateral eye injuries are as high as 15 percent. Many of these war-blinded can be cured. The four groups in which restoration is possible are those with traumatic cataract, corneal opacities, detachment of the retina, or hemophthalmos. In the author's material, all the traumatic cataracts were the result of perforating injuries and two thirds of them were found in the only remaining eye; but only 17 of them were free from complication by other lesions. The extractions were done within one to two months in most cases, and the results do not justify the traditional practice of waiting 6 to 12 months. There is no hurry when the other eye is normal. Special care to insure results is imperative in the one-eyed. Preliminary sterilization of the conjunctival sac is necessary, and the older methods, with mercury oxycyanide, collargol, and quinine, were found superior to streptocide or albucid. Complete anesthesia and akinesia are necessary. The corneal section is done with a small conjunctival flap and keratome, and is enlarged with scissors when necessary. Capsulotomy is done with capsule forceps rather than with cystotome. The lens matter, often sticky, is removed with a grooved spatula aided by pressure with Daviel's spoon. The rare vitreous presentation is controlled with a conjunctival suture. Occasionally a foreign body has to be extracted from the vitreous with the electromagnet after the cataract extraction. Nonmagnetic foreign bodies have been left alone without any ill results after two years of observation. The results

of extraction are good in a majority of the cases. In one case retinal detachment followed extraction. The majority of the corneal-scar group was complicated by secondary glaucoma difficult to combat. The best results were secured from Vogt's diathermy coagulation. Keratoplasty was done in ten cases with meager results. The prognosis in operations for detachment were found best when no proliferating retinitis was present. The results in hemophthalmos cases were not encouraging, probably because the material was too old at the base hospital for successful treatment. In conclusion the author points out that one has to take a chance in cases which would be turned down in peacetime.

M. Davidson.

·Vancea, P. **The retinal hemorrhages of the new-born.** Klin. M. f. Augenh., 1941, v. 107, Sept., pp. 272-274.

The author systematically examined the eye grounds of 253 new-born babies delivered in obstetrical hospitals in which the best care was assured. Retinal hemorrhages were found in 27 cases (11.8 percent), 18 bilateral, 11 unilateral. In only 9 of these was premature rupture of the membrane observed. In all cases the mother's pelvis was narrow. In one case delivery was accomplished by abdominal Cesarean section. The hemorrhages often absorbed within 10 to 12 hours, usually within two or three days, in eight cases within one week, in one case within two weeks. The author believes it possible that there may be a causal connection between retinal hemorrhage of the new-born and certain amblyopias (strabismus), and also of Coats's retinitis exudativa. F. Nelson.

Yuzefova, F. I. **An evaluation of the results of surgical and conservative treatment of perforating injuries of the eye.** Viestnik Oft., 1944, v. 23, pt. 4, p. 24.

Since there has been some discussion recently as to the value of Kuhnt's conjunctival keratoplasty in perforating eye injuries in war, the author surveyed the results in one hospital where a series of 70 cases in 1940 and 1941 had been handled conservatively, that is without resorting to keratoplasty, and another series of 70 cases in 1942 and 1943 had been handled surgically. To make the two series comparable, cases with intraocular foreign bodies were excluded. The first series showed 14 enucleations, 16 cases with vision worse as end result, 22 blind as end result; while in the second series only 6 enucleations were found necessary, only 6 resulted in blindness, and none showed vision made worse. The author therefore advocates Kuhnt's operation. But preliminary care of the wound should include excision of prolapsed tissue, and use should also be made of galvanocautery, sulfidine powder, and retrobulbar anesthesia.

M. Davidson.

17

SYSTEMIC DISEASES AND PARASITES

Friedrich, W. M. **Ocular tuberculosis in its relation to the body as a whole.** Supplement 11, Klin. M. f. Augenh., 1942, Supplement 11, 126 pp.

Over 2,000 patients with ocular tuberculosis have been cared for at the institute at Höchenschwand. After the first 500 had been seen the staff at the institute was in a position to investigate and treat all the clinical material on the basis of a unified point of view. The author suggests that in all previous literature on tuberculosis it has been assumed that after an initial attack of tuberculosis in an organ all

subsequent activity of the lesion takes place in the same organ without involvement of other organs. This conception is fundamentally false. The author conceives tuberculosis as a lymphohematogenous infection which becomes manifest now in one organ and now in another. Tuberculosis is not a disease that occurs in one or more attacks, but extends over decades, sometimes throughout an entire life.

All episodes of illness of possible tuberculous etiology in the patient's history must be justly evaluated in relation to the entire picture. To make this clear the author analyzed the records of over 1,500 patients. The largest number of them were between 30 and 40 years of age, because the patients were drawn from a group of industrially insured persons. One quarter of them had iridocyclitis, and patients in whom the ocular lesions were uveal—that is, iritis, choroiditis, endophthalmitis, or generalized uveitis, constituted 705 of the total number. (Bibliography.)

F. Herbert Haessler.

Klar, R. **On dentogenous focal infection in ocular inflammation.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 159-165.

The author presents a rather skeptical discussion of the importance of apical dental lesions in ocular infections. His own material consists of 155 patients with ocular infections, of whom 120 or 77 percent had dental infections which in the opinion of workers in the University Dental Clinic were potential foci of infection. In 98 patients or 63 percent the dental lesion was the only potential focus found. To provide a control series the author induced the dental clinic to examine the teeth of 155 entirely normal individuals and found that 100 of them or 64 percent had similar dental lesions. (Bibliography.)

F. Herbert Haessler.

Suurküla, J. **Eye diseases caused by the larva of diptera (ophthalmomyiasis).** Klin. M. f. Augenh., 1942, Supplement 13, 40 pp.

In this monograph the author reviews systematically the information recorded in 132 communications in the literature. In primary ophthalmomyiasis the larvae from flies belonging to the following families have been found: Tachinidae, Sarcophagidae, Calliphoridae, Oestridae, Castrophilida, and Phocidae. In the conjunctival sac the commonest larvae are those of Oestrus ovis. In the lids the larvae found in the majority of cases were Dermatobia cyaniventris and Wohlfahrtia magnifica. The same two larvae have been repeatedly extracted from the orbit, to which they probably gained access through the mucosa at the internal angle.

Thirty cases of intraocular larval invasion have been recorded. Hypoderma was the common genus, much more rarely Wohlfahrtia magnifica. It is highly probable that in cases where the latter larva was reported the diagnosis was erroneous, since this organism is very poorly adapted for intraocular parasitism. However, the presence of numerous larvae of this species, as well as of Sarcophaga carnario and Calliphora vomitoria, in ulcerated fistulous partially destroyed globes has been unquestionably observed. Most cases of ophthalmomyiasis are reported from southern countries. In northern latitudes infection is predominantly with Hypoderma, and is most common near the coast. This is the fly that causes most of the cases of ophthalmomyiasis interna. The

periodicity in the occurrence of morbid manifestations is ascribed to the gradual development of anaphylactic reactions. Inoculation presumably occurs when the adult fly in flight deposits its eggs on the surface of the tissue. Very malignant and generalized larval invasions occur only in decrepit individuals and in bodies with considerably reduced resistance. (2 tables, 12 figures, 2½ pp. bibliography.)

F. Herbert Haessler.

Szinegh, Béla. **Parenteral liver injections in the diagnosis and treatment of tuberculous eye diseases.** Klin. M. f. Augenh., 1941, v. 107, Aug., pp. 166-172.

A patient who has tuberculosis and who does not react to intradermal injection of tuberculin is said to be in an anergic state. This is not advantageous from either the diagnostic or the therapeutic point of view. The patient is unable to produce antibodies and the injection of tuberculin is useless. The author describes the clinical course of five patients in whom parenteral injection of a liver preparation made for treatment of pernicious anemia was effective in "disanergizing" the body. The preparation (Perhepar) is used intramuscularly twice daily for a week. The liver extract produces a reticulocytic crisis. Normal control individuals remain inactive to tuberculin injection after repeated injections of liver extract. (References.)

F. Herbert Haessler.

Wegner, W. **Difficulties in differential diagnosis of ocular tuberculosis.** Klin. M. f. Augenh., 1941, v. 107, Oct., pp. 337-348.

Since it is becoming clear that tuberculosis is the most important etiologic factor in chronic inflammatory lesions of the interior of the eye, its importance in differential diagnosis can hardly be overemphasized. To clarify the difficulties the author records over a dozen case histories, rather briefly though in adequate detail, and discusses each. Diagnostic errors that were made because of possibly faulty examination or inadequate analysis of facts do not form part of this study. Errors may be made by dismissing too readily the importance of a personal and family history, but also by laying undue stress on these data. In three cases a sympathetic ophthalmia had been wrongly diagnosed elsewhere as tuberculosis, and in several cases a cronic internal irritation caused by an intraocular foreign body was not suspected until signs of siderosis appeared. In one case of severe bilateral intraocular inflammation in a patient who was neither underweight nor febrile, the correct diagnosis was not made until autopsy revealed a most extensive tuberculosis of all the thoracic and abdominal lymph nodes. The patient died of amyloidosis of the kidney. Atypical trachoma and syphilitic lesions of the eye may lead to serious diagnostic difficulties. In a young man of 26 years with extensive bronchial carcinoma and metastasis to the vertebrae, liver, and eyes, no etiologic diagnosis was made by either internist or oculist. After displaying this small collection of diagnostic difficulties the author is disposed to humility. (References.)

F. Herbert Haessler.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Csapody, Istvan. **The professional life of the ophthalmologist.** Klin. M. f. Augenh., 1942, Supplement 10, 92 pp.

This well-written, readable pamphlet is presumably addressed to medical students and recent graduates who might consider preparing themselves for the practice of ophthalmology. The author describes (1) the characteristics of mind, body, and temperament that best fit a man for the specialty; (2) the course of training which will fit a candidate for surgery and consultation practice; (3) the daily routine of the eye doctor in clinic, private consultation room, hospital and surgery; (4) the person-to-person relationship between doctor and patient when preparing the patient mentally for operation or for impending blindness; and (5) the ophthalmologist's duties in giving expert opinion on matters of compensation and litigation.

F. Herbert Haessler.

Kravkov, S. V. **Jan Purkinje and ophthalmology.** Viestnik Oft., 1944, v. 23, pt. 5, p. 3.

On the occasion of the 25th anniversary of the death of Czech scientist Purkinje, attention is called to his three great contributions to the physiology of vision. It is pointed out that the reflex images of the lens were described by him in 1825, and were later (1837) applied by the Frenchman Sanson in diagnosis; and were still later utilized by Helmholtz, who measured the changes in size of the images, in developing his theory of accommodation. The second important contribution was the construction in 1823 of the first perimeter, accompanied by many practical suggestions on performing perimetry. Aubert and Foerster to whom the first perimeter is usually credited did not act until 1857. The third very important contribution, known as the Purkinje phenomenon, and consisting in blue appearing much brighter than red in twilight, laid the foundation for the duplicity theory of Kries, and was utilized by Kravkov in exploration of dark adaptation. Other contributions of Purkinje deserving mention are his discussion of positive afterimages of the complementary color, of phosphenes from pressure and electric stimuli, of methods of entoptic examination of the retinal vascular network (which later (1872) enabled Mueller to determine the position of the percipient layer of the retina and identify it as the layer of rods and cones), of the effect of belladonna on the eyes, of the possibility of voluntary unilateral adduction of an eye while the other is stationary, and of the physiologic substratum of sleepiness being referred to the eyes. Attention is also called to Purkinje's activities as a Czech patriot struggling against the German-Austrian oppression of his days.   M. Davidson.

Lisch, Karl. **Sterilization and success of treatment in serious hereditary eye diseases.** Klin. M. f. Augenh., 1941, v. 107, Nov., pp. 521-526.

Reply to the critical article of R. Schmidt (see below) concerning the author's previous article on this theme. Lisch insists that it is not permissible to allow reproduction by individuals suffering from hereditary cataract of any type. "He who is doing race hygiene must never think therapeutically but only heredobiologically." It does not matter that a condition can be completely repaired, either surgically or otherwise. It is the task of a race-conscious physician to eliminate the genotype from reproduction even if the phenotype can be rendered practically normal by therapeutic means. As to the question of elimination of more or

less serious refractive errors he feels that our knowledge of the mode of inheritance of such errors is not yet broad enough to justify sterilization in such cases, unless the condition renders the patient practically blind for distance as well as for near and at least one other such case in the family is known. (References.)

F. Nelson.

Mills, E. T. **Medical social work in sight conservation as developed in the State of Washington.** Sight-Saving Review, 1944, v. 14, Winter, p. 170.

The author describes the plan of sight conservation used by the Department of Social Security, and brief individual case records show some of the end results. Francis M. Crage.

Nuri Fehmi Ayberk. **Review of the history of Turkish ophthalmology from the nineteenth century to the present.** Göz Klinigi, 1945, v. 2, no. 5, pp. 119-122; and no. 6, pp. 145-150.

In 1839 under the reign of Sultan Mahmoud II, there was inaugurated a school of medicine (at first called "justice," then "military"), directed by a Viennese physician, Dr. Bernard, in the same location as the present Galata Saray Lyceum. The teaching of ophthalmology began in this school in 1853. The official Chair of Ophthalmology was established in 1870, and was committed to Colonel Ilya Abdunnur, who had taken his training in France. Upon his death he was succeeded by Major Essad (1895), who also had specialized in Paris. In the same period a certain Behdjet taught ophthalmology to the civil medical school. In 1908, when the two schools were combined to form the faculty of medicine, General Essad and Dr. Ziya, who had studied in Germany, were appointed professors simultaneously. The first eye clinic in Turkey was inaugurated at the Military School of Medicine of Demirkapou in 1895, with Professor Essad. The previous teaching had all been theoretical.

Apart from the teaching in the military and civil schools of medicine, the Military Hospital of Haydar Pasha (1871 to 1900) and then the Military Hospital of Gulhané (1900 to 1945) were two centers where it was possible to specialize in ophthalmology. Two eminent teachers, one at the Military Hospital of Haydar Pasha, Colonel Dikran Adjemyan (1875 to 1908), and the other at the military school and Hospital of Gulhané, General Niyazi Ismet Gözcü (1909-1944), showed great scientific activity, especially the latter, who trained a considerable number of distinguished oculists. (3 photographs.)

W. H. Crisp.

Prelat, P. **Ophthalmology in Paris during the war.** Amer. Jour. Ophth., 1945, v. 28, Oct., pp. 1088-1111.

Schmidt, Rolf. **The question of sterilization of persons with "inherited cataract."** (Reply to article by Lisch.) Klin. M. f. Augenh., 1941, v. 107, July, pp. 67-72.

In contrast to Lisch (Amer. Jour. Ophth., 1942, v. 25, p. 127), who, literally following the Nazi law of elimination by sterilization of all persons who might transmit hereditary disorders, regardless of whether or not they were curable, Schmidt advocates sterilization of all persons with "hereditary cataracts." Although advocating elimination of persons with so-called complicated cataracts, he is opposed to sterilization of persons suffering from noncomplicated simple cataracts. In this connection cataracts are to be re-

garded as complicated when the carrier is either himself mentally or physically inferior or belongs to a family the members of which frequently have cataracts complicated with such other defects as lack of foveal function, nystagmus, and additional physical or mental malformations which, according to experience, cannot be treated successfully by operation or other means. Schmidt argues consequently that higher or even medium refractive errors which render the bearer "practically blind" without therapeutic procedures (that is, corrective glasses) would have to be eliminated too, since many of these refractive errors are also inherited. (References.)   F. Nelson.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Balado, M., and Fortin, E. P. **Regional anatomy of the fibers of the macular area.** Arch. de Oft. de Buenos Aires, 1943, v. 18, May, pp. 245-265.

In this article the authors study and discuss the course and arrangement of the retinal fibers, particularly those of the macular region, by means of entoptic observation and histologic preparations. The article does not lend itself to abstracting. (17 illustrations.)
Plinio Montalván.

Vidal, F., and Malbrán, J. **Arrangement of the peripheral nasal bundle in the human chiasm.** Arch. de Oft. de Buenos Aires, 1943, v. 18, July, pp. 339-345.

In a specimen from a case of optic atrophy of the left side the authors studied the arrangement of the peripheral nasal fibers in the chiasm. In the sagittal section it was observed that the lamina supraoptica divided the upper

aspect of the chiasm into an intraventricular and extraventricular portion. The nasal peripheral bundle occupied the extraventricular portion and was in close relation with the cisterna chiasmatica. In the specimen under study the bundle ran from right to left and from above downward, occupying the anterior knee of the chiasm and invading the optic nerve in an extension of approximately 500 microns, where it occupied the inner and lower aspects. This arrangement explains the prechiasmal thickening clearly seen in the sagittal section. In the two posterior thirds of the chiasm the fibers under consideration occupied the external border. (5-photomicrographs, references.)   Plinio Montalván.

Vidal, F., and Malbrán, J. **Studies on the chemical composition of the aqueous humor of the cat.** Arch. de Oft. de Buenos Aires, 1943, v. 18, May, pp. 231-237.

In this article, the second of a series on the subject, the authors describe their procedure for obtaining samples of aqueous humor and the analytical methods followed for quantitative determination of sodium, chlorine, ascorbic acid, total nitrogen, nonprotein nitrogen, proteins, water and ashes, glucose, and pH. The article does not lend itself to abstracting.
Plinio Montalván.

Vidal, F., and Malbrán, J. **Studies on the chemical composition of the aqueous humor of the cat. 3. Sodium and chlorine.** Arch. de Oft de Buenos Aires, 1943, v. 18, June, pp. 299-310.

The authors determined the contents of sodium and chlorides in the aqueous humor of the cat. They present their figures in tabulated form and compare

them with those found by other observers. The article does not lend itself to abstracting. (4 tables, references)

Plinio Montalván.

Vidal, F., and Malbrán, J. **Studies on the chemical composition of the aqueous humor of the cat. 4. Protein and nonprotein nitrogen, water, and ash.** Arch. de Oft. de Buenos Aires, 1943, v. 18, July, pp. 345-355.

The authors present in tabulated form the figures for protein and nonprotein nitrogen, water, and ash in the aqueous humor of the cat. The values for protein nitrogen in the primary aqueous are considerably higher than those reported by other observers. The marked increases found by the authors in protein content in the secondary or plasmoid aqueous agree with the figures published by previous observers. The changes which the endothelial barrier undergoes after paracentesis of the anterior chamber and the formation of plasmoid aqueous are strong points in favor of the theory which considers the aqueous as a dialysate. The figures for nonprotein nitrogen are comparable to those of other observers and the proportions of nonprotein nitrogen in aqueous humor and blood found by the authors are similar to these obtained by Krause and Yudkin in the dog. (6 tables, bibliography.)

Plinio Montalván.

NEWS ITEMS

Edited by Dr. Donald J. Lyle
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month.

DEATHS

Dr. Albert H. Aland, Los Angeles, California, died July 24, 1945, aged 56 years.

Dr. William L. Atkins, Shreveport, Louisiana, died June 16, 1945, aged 52 years.

Dr. Chester B. Bliss, Sandusky, Ohio, died July 10, 1945, aged 71 years.

Dr. William C. Brown, Oak Park, Illinois, died August 1, 1945, aged 79 years.

Dr. Henry L. Crahan, Rutland, Vermont, died July 28, 1945, aged 66 years.

Dr. George B. Crist, Frederick, Maryland, died April 8, 1945, aged 52 years.

Dr. George H. Ensminger, Chicago, Illinois, died August 23, 1945, aged 67 years.

Dr. Valentine B. Fisher, Boulder, Colorado, died August 3, 1945, aged 59 years.

Dr. William E. Foster, Babylon, New York, died August 30, 1945, aged 78 years.

Dr. Julian E. Hanna, Noblesville, Indiana, died July 29, 1945, aged 74 years.

Dr. Edward A. Hanske, Bellevue, Iowa, died June 21, 1945, aged 72 years.

Dr. William M. Holmes, Marionville, Missouri, died June 28, 1945, aged 82 years.

Dr. Douglas P. A. Jacoby, Newport, Rhode Island, died August 25, 1945, aged 72 years.

Dr. George W. Mackenzie, Philadelphia, Pennsylvania, died August 5, 1945, aged 73 years.

Dr. Jonathan T. Male, Yampa, Colorado, died July 15, 1945, aged 76 years.

Dr. John E. Manney, San Antonio, Texas, died May 27, 1945, aged 72 years.

Dr. Abraham L. Morris, Chicago, Illinois, died July 27, 1945, aged 62 years.

Dr. Edward L. Morrison, Washington, D.C., died August 14, 1945, aged 72 years.

Dr. Henry A. Shaw, Pittsburgh, Pennsylvania, died May 14, 1945, aged 63 years.

MISCELLANEOUS

Members of the San Antonio Ophthalmo-Otolaryngological Society conferred with military medical men November 13th at the Army Air Forces School of Aviation Medicine, Randolph Field, Texas, on methods of combating eye, ear, nose, and throat diseases.

Members of the teaching staff of the military installation discussed the utilization of new drugs in the prevention and control of ophthalmo-otolaryngologic diseases. Displayed at the conference were medical photographs and art work pertaining to eye, ear, nose, and throat diseases. The program also featured a demonstration of a new magnetic wire recorder by Major Hubert B. Peugnet, Saint Louis, Missouri, which is used in research studies in the AAF School of Aviation Medicine Department of Otolaryngology.

Brig. Gen. Eugene G. Reinartz, Commandant of the School, welcomed the Society to the facilities of the research laboratory following a reception and dinner at the Randolph Field Officers Club.

Lt. Col. Brittain F. Payne, New York City, and Captain Fred W. Ogden of New Orleans, Louisiana, assisted Drs. Virgil S. Steele and Dan Russell of San Antonio in organizing the program.

The following courses will be given by the Harvard Medical School: March 4 to April 27, 1946—Basic science in ophthalmology; April 29 to May 25, 1946—Clinical ophthalmology; and May 27 to June 22, 1946—Fundamentals in refraction. These courses are being given at this time particularly for the men returning from the Armed Forces.

At the postgraduate courses given by the University of Buffalo School of Medicine, Dr. Walter F. King, Associate Professor of Ophthalmology, lectured on "Office management of injuries, foreign bodies, and infections of the eyes."

SOCIETIES

The officers of the Brooklyn Ophthalmological Society for the year 1945-1946 are: Dr. Michael J. Buonaguro, president; Dr. Benjamin C. Rosenthal, vice-president; Dr. Louis Freimark, secretary-treasurer; and Dr. George A. Graham, associate secretary-treasurer.

The Mississippi Valley Medical Society is resuming its annual essay contest, which has not been held during the war. In 1946 it offers a cash prize of $100.00, a gold medal, and a certificate of award for the best unpublished essay on any subject of general medical interest (including medical economics) and practical value to the general practitioner of medicine. Certificates of merit may also be granted to the physicians whose essays are rated second and third best. Contestants must be members of the American Medical Association who are residents of the United States.

Contributions should not exceed 5,000 words, be typewritten in English in manuscript form, submitted in five copies, and must be received not later than May 1, 1946.

Further details may be secured from Dr. Harold Swanberg, secretary, Mississippi Valley Medical Society, 209-224 W.C.U. Building, Quincy, Illinois.

At the regular meeting of the Brooklyn Ophthalmological Society, held on December 20th, the following scientific program was given: "The so-called demyelinizing diseases of the nervous system and their relationship to ophthalmology" by Dr. A. M. Rabiner, and "Arachnoiditis" by Dr. Daniel Kravitz, dis-cussion by Dr. E. Jefferson Browder.

At the meeting of the Milwaukee Oto-Ophthalmic Society which was held on November 27th, Dr. S. S. Blankstein presented a paper on "Surgery of the lacrimal apparatus."

PERSONALS

Lt. Col. M. E. Randolph (MC), Chief of the Eye, Ear, Nose, and Throat Section at Valley Forge General Hospital, was transferred to the Office of The Surgeon General, Washington, D.C., to serve as Chief Consultant in Ophthalmology to the Surgeon General. He will be replaced by Lt. Col. Phillips Thygeson (MC).